THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

Volume 16 OCTOBER, 1937 Number 10

ECKARDT V. ESKESEN

For story of Mr. Eskesen, see page 412.

NOVEL COLOR EFFECTS FOR GLASS

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THE BULLETIN OF THE AMERICAN CERAMIC SOCIETY

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Publication Office: 20th & Northampton Sts., Easton, Pa.
Editorial and Advertising Office: 2525 N. High St., Columbus, Ohio.
Executive Office: 2525 N. High St., Columbus, Ohio.
Committee on Publications: J. D. SULLIVAN, *Chairman;* R. F. SHERWOOD, E. DE F. CURTIS, W. W. WINSHIP, ROSS C. PURDY.

Entered as second-class matter at the post office at Easton, Pa., under the act of March 3, 1879. Published monthly.
Subscription $1.50 a year. Single numbers twenty-five cents
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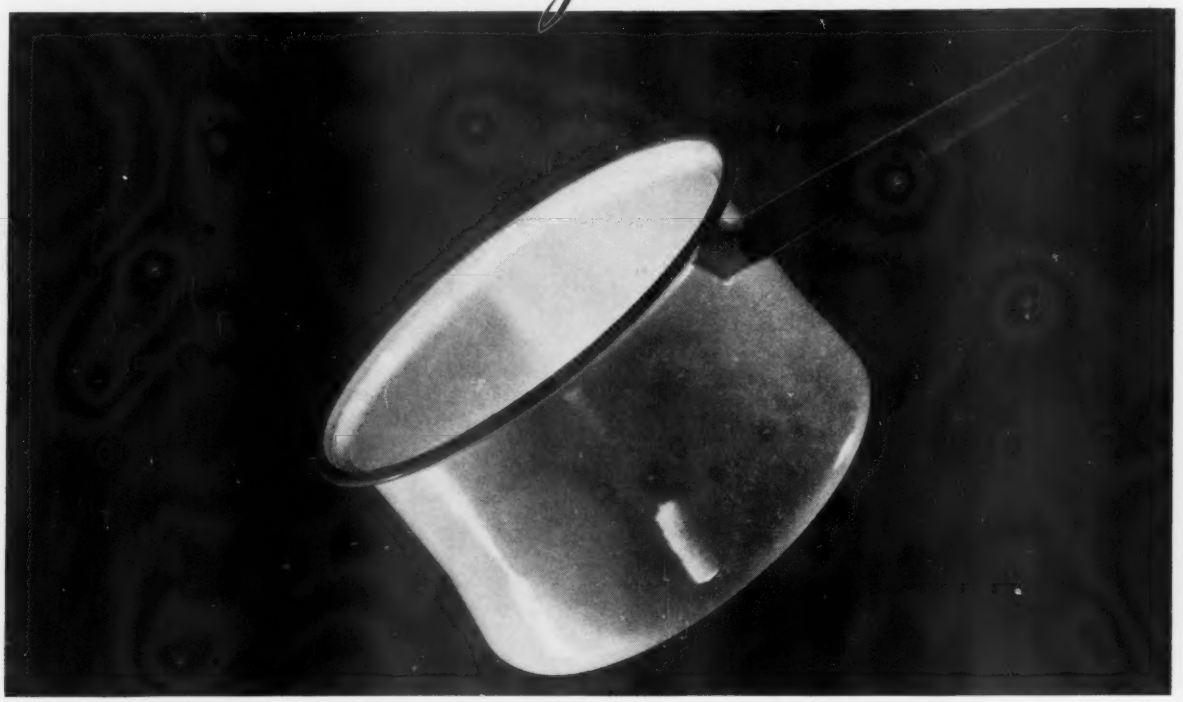

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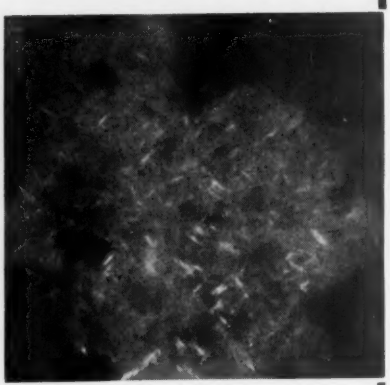

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Harshaw Chemical Co.

Colors
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Harshaw Chemical Co.
Pittsburgh Plate Glass Co.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cones
The Edward Orton, Jr., Ceramic Foundation

Conveying Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.

Copper Oxide
Harshaw Chemical Co.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.

Crucibles (Filter, Melting, Ignition)
Carborundum Co.
Denver Fire Clay Co.
Norton Co.
Pittsburgh Plate Glass Co.
Potters Supply Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Decorating Supplies
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Harshaw Chemical Co.
Pittsburgh Plate Glass Co.
The Vitro Mfg. Co.

Disintegrators
Lancaster Iron Works, Inc.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enameling Equipment (Complete)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Electro Refractories & Alloys Corp.
The Hommel Co., O., Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.
Bethlehem Steel Co.

Enameling Muffles
Bethlehem Steel Co.
Carborundum Co. (*Carbofrax*)
Chicago Vitreous Enamel Product Co.
Electro Refractories & Alloys Corp.
Frazier-Simplex, Inc.
Norton Co. (*Alundum*)
Pittsburgh Plate Glass Co.

Enameling (Practical Service)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pittsburgh Plate Glass Co.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Enamels (Porcelain)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Equipment (Porcelain Enameling)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The DeVilbiss Co.
The Hommel Co., O., Inc.

Exhaust Systems
The DeVilbiss Co.

Feldspar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.
Sant, Richard C.
The Vitro Mfg. Co.

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Spinks Clay Co., H. C.

Flint
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.

Flint Pebbles
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.

French Flint
Consolidated Feldspar Corp.
Paper Makers Importing Co.

Frit
Allied Engineering Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Frosting Mixtures
Harshaw Chemical Co.

Fuel Oil Systems and Control, Stokers
Bethlehem Steel Co.
Frazier-Simplex, Inc.

Furnaces
Allied Engineering Co.
Carborundum Co. (*Carboradiant*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Hartford-Empire Co.
Lancaster Iron Works, Inc.

Glass Melting Pots (Open and Covered)
Pittsburgh Plate Glass Co.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.
Pittsburgh Plate Glass Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Glazes and Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Glaze Spar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.

Goggles
Cover, H. S.
Willson Products, Inc.

Gold
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. H. & Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Dept.

Gold Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Co.
Granulators
Lancaster Iron Works, Inc.
Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Chicago Vitreous Enamel Product Co.
Norton Co. (*Alundum-Crystolon*)
Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co. (*Crystolon*)
Hearths (Fused Al_2O_3, SiC)
Electro Refractories & Alloys Corp.
Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.
Hose (Air and Fluid)
The DeVilbiss Co.
Hydrofluoric Acid
Harshaw Chemical Co.
Iron Chromite
Harshaw Chemical Co.
Iron (Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.
Iron Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.
Kaolin
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
Sant, Richard C.
United Clay Mines Corp.
The Vitro Mfg. Co.
Kellog AA Refractories
Electro Refractories & Alloys Corp.
Kilns, China (Decorating)
Allied Engineering Co.
Denver Fire Clay Co.
Drakenfeld & Co., B. F.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide)
Electro Refractories & Alloys Corp.
Kyanite
Celo Mines, Inc.
Kryolith (See Cryolite)
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.
Laboratory Ware
Norton Co.
Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.
Lehrs
Frazier-Simplex Inc.
Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Lehr Loaders
Frazier-Simplex, Inc.
Linings (Furnace Refractory, Block Refractory Plate, Brick and Tile)
Carborundum Co.
Chicago Vitreous Enamel Product Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pittsburgh Plate Glass Co.
The Vitro Mfg. Co.
Lithium Carbonate
Foote Mineral Co.
Lithium Minerals
Foote Mineral Co.
Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.
Magnesia (Sintered, Calcined)
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The Hommel Co., O., Inc.
The Vitro Mfg. Co.
Manganese Dioxide
Foote Mineral Co.
Manganese (Oxide)
Ceramic Color & Chemical Mfg. Co.
Corhart Refractories Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
Masks (Breathing)
The DeVilbiss Co.
Willson Products, Inc.
Metals (Porcelain Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.
Microscopes (Polarizing)
Bausch & Lomb Optical Co.
Minerals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.
Mixers (Batch)
Lancaster Iron Works, Inc.
Mold Sanders
Lancaster Iron Works, Inc.
Muffles (Furnace)
Allied Engineering Co.
Carborundum Co. (*Carbofrax*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Frazier-Simplex, Inc.
Norton Co.
Pittsburgh Plate Glass Co.
Muffles (Laboratory)
Electro Refractories & Alloys Corp.
Mullite (Refractories)
Electro Refractories & Alloys Corp.
Muriatic Acid
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Needle Antimony
Harshaw Chemical Co.
Nickel Salts
Harshaw Chemical Co.
Nitrates (Cobalt, Sodium)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.
Nitre
Harshaw Chemical Co.
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The Hommel Co., O., Inc.
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The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.
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Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Oxides
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
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Harshaw Chemical Co.
Metal & Thermit Corp.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.
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Pins
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The Hommel Co., O., Inc.
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Platinum Decorations
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Polariscopes
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Ceramic Color & Chemical Mfg. Co.
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The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.
Porcelain Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.
Potash (Carbonate)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
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The Hommel Co., O., Inc.
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The Vitro Mfg. Co.
Producer Glass Plants
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Pug Mills
Lancaster Iron Works, Inc.
Pyrites (Natural Iron Sulphide)
Foote Mineral Co.
Pyrometer Tubes
Carborundum Co.
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Montgomery Porcelain Products Co.
Pyrometer Tubes (Refractory and Hard Porcelain)
Denver Fire Clay Co.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.
Pyrometers (Optical, Radiation, Surface, Immersion, Needle)
Pyrometer Instrument Co.
Pyrometric Cones
The Edward Orton, Jr., Ceramic Foundation
Raw Material Handling Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Refractometers
Bausch & Lomb Optical Co.
Refractories
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Kentucky-Tennessee Clay Co.
Norton Co.
Pittsburgh Plate Glass Co.
Refractory Materials
Carborundum Co.
Chicago Vitreous Enamel Product Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Kentucky-Tennessee Clay Co.
Norton Co.
Pittsburgh Plate Glass Co.
Sant, Richard C.
Titanium Alloy Mfg. Co.
Represses (Automatic)
Lancaster Iron Works, Inc.

Respirators
Chicago Vitreous Enamel Product Co.
Cover, H. S.
The DeVilbiss Co.
The Hommel Co., O., Inc.
Willson Products, Inc.

Rutile
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Saggers
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Potters Supply Co.

Salt Cake
American Potash & Chemical Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Sandblast Helmets
Willson Products, Inc.

Sand Grinder and Sifters
Lancaster Iron Works, Inc.

Saponin
The Hommel Co., O., Inc.

Selenite of Sodium
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Selenium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
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Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Sheets (Enameling Iron)
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Bethlehem Steel Co.

Silica (Fused)
Electro Refractories & Alloys Corp.
The Hommel Co., O., Inc.

Silicate of Soda
Ceramic Color & Chemical Mfg. Co.
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The Hommel Co., O., Inc.
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Carborundum Co.

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Electro Refractories & Alloys Corp.
Norton Co.
Pittsburgh Plate Glass Co.

Soda Ash
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Ceramic Color & Chemical Mfg. Co.
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Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pittsburgh Plate Glass Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Sodium Antimonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
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Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Sodium Fluoride
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Sodium Metasilicate
Harshaw Chemical Co.

Sodium Nitrite
Harshaw Chemical Co.

Sodium Silica Fluoride
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Sodium Uranate
Harshaw Chemical Co.

Soot Blowers
Frazier-Simplex, Inc.

Special Machines
Frazier-Simplex, Inc.

Spar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Spray Booths
The DeVilbiss Co.

Spraying Equipment
The DeVilbiss Co.

Spurs
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Stilts
Potters Supply Co.

Sulfuric Acid
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Talc
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.

Tanks
Frazier-Simplex, Inc.

Tank Blocks
Corhart Refractories Co.
Pittsburgh Plate Glass Co.

Tanks (Pickle)
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.

Tanks for Raw Material Steel or Concrete
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Tile (Refractory)
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Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pittsburgh Plate Glass Co.

Tile (Wall)
Denver Fire Clay Co.

Tin Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Titanium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Tri Sodium Phosphate
Harshaw Chemical Co.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
Carborundum Co.
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.
Pittsburgh Plate Glass Co.

Uranium Oxide
Harshaw Chemical Co.

Uronium Oxide (Yellow-Orange-Black)
Du Pont de Nemours, E. I., & Co., Inc. R. & H. Chemicals Dept.
The Vitro Mfg. Co.

Water Softening Plants
Frazier-Simplex, Inc.

Wet Enamel
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Whiting
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Winding Drums
Lancaster Iron Works, Inc.

Zinc Oxide
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Zircon
Foote Mineral Co.

Zirconia
Ceramic Color & Chemical Mfg. Co.
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Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
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The Vitro Mfg. Co.

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PERFORMANCE DATA FOR ONE TANK, OVER A PERIOD OF 8 YEARS

DATE →	Jan. '28 July '28	Sept. '28 May '29	June '29 Apr. '30	June '30 Sept. '31	Nov. '31 Dec. '32	Feb. '33 March '34	May '34 Dec. '35	Jan. '36 Aug. '36 (Now Operating)	Jan. '36 to June '37
MATERIAL IN FURNACE→	All Clay 15" Sidewalls	All Clay 15" Sidewalls	Corhart Bridgewall 15" Clay M. E. Sidewalls	Corhart Bridgewall and 12" Thick Corhart Top Course And 15" Thick Clay Lower Course M. E.	All Corhart 12" M. E. Sidewalls	All Corhart 12" M. E. And 120 Sq. Ft. Corhart M. E. Bottom	All Corhart 12" M. E. And One-Half Corhart M. E. Bottom	All Corhart 10" M. E. And One-Half Corhart M. E. Bottom	O. K.
Melting Area (Sq. Ft.)	834	834	834	834	834	834	834	854	O. K.
Days Life	**212**	**246**	**300**	**482**	**405**	**413**	**600**	**213**	500
Failed	Throat	Throat	Sidewall	Lower Course Sidewall	Bottom	Clay Portion Bottom	Throat	Operating	**No failure. Tank shut down for seasonal reasons.**
Operating Days	175	201	249	365	330	335	500	182	437½
Tons Glass Delivered	**6,648**	**8,620**	**10,356**	**16,400**	**17,561**	**19,873**	**39,134**	**18,982**	47,753
Tons Coal Used	**4,292**	**4,810**	**6,215**	**10,540**	**10,680**	**10,208**	**19,154**	**7,031**	17,176
B. T. U. to Furnace 70% Producer Efficiency	$79.016x10^8$	$88.352x10^8$	$114.418x10^8$	$194.042x10^8$	$196.619x10^8$	$187.929x10^8$	$352.625x10^8$	$129.441x10^8$	$316,210x10^6$
Fuel To Melt Glass $3x10^6$ B. T. U. Per Ton	$19.994x10^8$	$25.860x10^8$	$31.068x10^8$	$49.200x10^8$	$52.683x10^8$	$59.619x10^8$	$117.402x10^8$	$56.946x10^8$	$143,259x10^6$
Total B. T. U. To Hold Temperature	$59.072x10^8$	$62.692x10^8$	$83.350x10^8$	$144.841x10^8$	$143.936x10^8$	$128.310x10^8$	$235.223x10^8$	$72.495x10^8$	$172,951x10^6$
B. T. U. To Hold Temperature Per Day	$278.640x10^3$	$254.846x10^3$	$277.834x10^3$	$300.501x10^3$	$351.397x10^3$	$310.679x10^3$	$392.039x10^3$	$340.351x10^3$	$345,902x10^3$
B. T. U. For Temperature For Total Idle Days	$10.310x10^8$	$11.468x10^8$	$14.170x10^8$	$35.159x10^8$	$26.655x10^8$	$24.233x10^8$	$39.204x10^8$	$10.551x10^8$	$21,619x10^6$
Total B. T. U. Consumed On Operating Days	$68.706x10^8$	$77.084x10^8$	$100.249x10^8$	$158.883x10^8$	$169.964x10^8$	$163.696x10^8$	$313.421x10^8$	$118.890x10^8$	$294,591x10^6$
B. T. U. Per Ton Glass Delivered	$103.348x10^2$	$89.425x10^2$	$96.802x10^2$	$96.880x10^2$	$96.785x10^2$	$82.371x10^2$	$80.089x10^2$	$62.633x10^2$	$61,691x10^2$
Lbs. of Coal Per Lb. of Glass	**0.65**	**0.56**	**0.60**	**0.64**	**0.61**	**0.51**	**0.49**	**0.37**	0.36
Sq. Ft. Melting Area Per Ton Glass Per Day	21.9	19.4	20.3	21.8	17.8	16.5	10.7	8.2	7.8
Tons Glass Per Day	37.99	42.89	41.59	44.93	53.22	59.32	78.27	104.30	109.15
Dead Load Factor % Ratio Waste Fuel to Total Fuel	74.75	70.80	72.85	74.64	73.21	68.28	66.71	56.01	54.69
B.T.U. Per Ton Glass as Cu. Ft. Natural Gas at 1000 B.T.U.	**10,335**	**8,943**	**9,680**	**9,688**	**9,679**	**8,237**	**8,009**	**6,263**	6,169
Approx. Total Repair Cost	**$7,000**	**$7,000**	**$7,800**	**$9,000**	**$11,400**	**$10,800**	**$15,000**		$16,493.00
Repair Cost Per Ton of Glass	**$1.05**	**$0.81**	**$0.75**	**$0.55**	**$0.65**	**$0.54**	**$0.38**		34½c

NOTE: This tank was 42' deep in all campaigns. The ware manufactured was flint containers. The fuel was Island Creek Coal (13,130 B. T. U. per pound)

A COMPLETE 8-FIRE RECORD OF ACHIEVEMENT

THE chart above was originally published last January, covering the performance of one tank through a period of change from all-clay construction to balanced Corhart construction. This period covered seven complete fires and a part of the *eighth* campaign.

This eighth fire has now been completed, and the last column of figures has been corrected, above, to show final results.

A careful study of these figures, from any angle or any point of view, discloses a continuously declining *fuel cost and repair cost per ton of glass*, over a period of eight fires—and that this has been achieved simultaneously with a constantly increasing use of Corhart Electrocast.

As we have often stated before, we do not claim credit for increase in fuel efficiency, because this is a function *only* of engineering and operation. We do claim, however, that all the records above are made possible by higher temperatures and rates of pull—which are themselves made possible by the use of a refractory capable of resisting such punishment. . . . Corhart Refractories Co., Incorporated, 16th & Lee Sts., Louisville, Ky. *In Europe:* L'Electro Refractaire, Paris. *In Japan:* Asahi Glass Co., Tokio.

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CORHART ELECTROCAST REFRACTORIES

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VOLUME 16 **OCTOBER, 1937** **NUMBER 10**

PAPERS

A NEW PROCESS NORTH CAROLINA KAOLIN REFINERY*

By J. R. Grout, Jr.

Abstract

A description and flow sheet of the new process North Carolina kaolin refinery are presented as well as the method of control used. A comparison is made of some properties of the kaolin produced by the old and new process, and an estimate of the clay reserves for the refinery is reported.

I. Introduction

North Carolina kaolin has been produced for forty-eight years and, with the exception of a few refinements, the process has been the same to the present time. After a year and a half of research, the plant described herein has been built and is in production. An old process plant has been in operation, using clay from the same mine for fifteen years, which makes possible a comparison of the processes and results.

II. History

Twenty-four years ago, Watts,[1] after an exhaustive study of the North Carolina kaolin situation, made some suggestions which are still used as a manual of procedure for kaolin refiners. Only two major changes had been made in the process as described prior to 1935, (1) the use of hydraulic mining and stripping and (2) reclamation of mica, which was suggested by Watts.

In 1915, Binns[2] and Brown,[3] among others, did some research in refining North Carolina kaolin by deflocculation. One year later Sproat[4] showed the benefits derived by Georgia kaolins by using dispersion with electrolytes. Several North Carolina refiners were unsuccessful in their efforts during the next twenty years to apply the principle, but the basic factor of control necessary to success was lacking until the process was successfully introduced in an old clay refining plant in 1935.

Previous to this commercial large-scale application, the problem was investigated in coöperation with the Tennesee Valley Authority and the Bureau of Mines.

III. Description of Refinery

The flow sheet of the clay refining process is shown in Fig. 1. The refinery, exclusive of power and drier buildings, is housed in four separate buildings. The buildings are tightly sealed and constructed entirely of wood to avoid iron contamination, except over the thickener where the long roof span requires a steel truss. Unit steam heaters maintain a uniform year-round temperature. Foundation walls, floors, hydroseparator, thickener, and slips tanks are of concrete.

Control rooms are partitioned off for the location of control equipment.

* Presented at the Thirty-Ninth Annual Meeting, American Ceramic Society, New York, N. Y., March 23, 1937 (White Wares Division). Received February 5, 1937.

[1] A. S. Watts, "Mining and Treatment of Feldspar and Kaolin," *Bur. Mines Bull.*, No. 53, June, 1913.

[2] C. F. Binns, "Comparison of Some Kaolins in Respect to Size of Grain," *Trans. Amer. Ceram. Soc.*, **17**, 356 (1915).

[3] G. H. Brown and W. L. Howat, "Use of Deflocculating Agents in Washing Clays and Effect of the Process upon Color," *ibid.*, **17**, 81 (1915).

[4] I. E. Sproat, "Kaolin Refining," *ibid.*, **18**, 767 (1916).

All water and clay pipes in the buildings are of copper. All iron work, which is reduced to a minimum, is painted periodically with black asphalt paint.

Power is generated on the site by stoker-fired steam equipment direct connected to 2300-volt generators. The engine exhaust is used for drying. The equipment is operated by direct-connected or silent-chain individual drives, with centrally located push button stations for the motors.

The magnetic filters are a specially adapted underfeed type, with the usual magnetic cut-out in case of power failure. The pressure tanks, which are set on end at each press, are large cylinders built to A.S.M.E. standards. After the

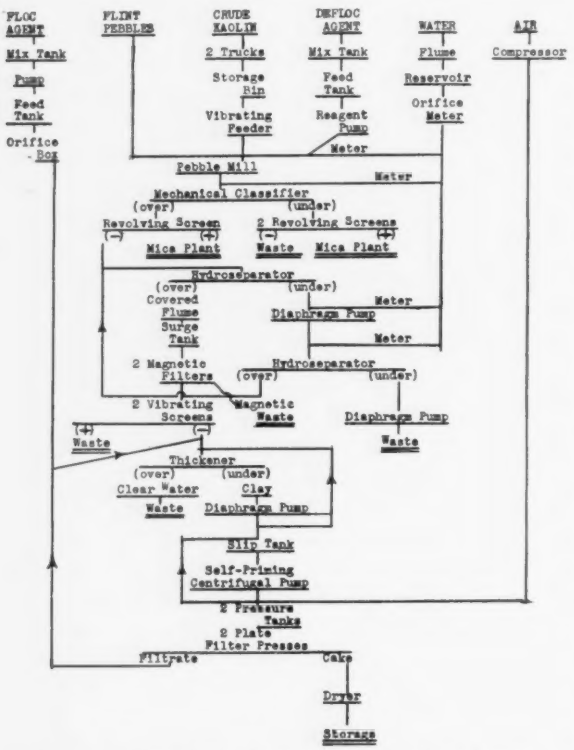

FIG. 1.—Flow sheet of new process kaolin refinery.

tanks are filled with clay slip, air pressure is applied to force the clay into the plate filter presses.

The machinery and equipment used otherwise are standard and may be found described in ore-dressing handbooks and machinery equipment catalogues.

Although vibrating screens were installed as a precautionary measure, so little residue was obtained that the screens are operated stationary. The final screening operation in the old process was a real problem, often requiring more than one hundred square feet of expensive screen wire, as well as the full time of a man to keep it clean.

IV. Control Methods

Control starts at the source of supply where hand loading enables selective picking, eliminating off-color clay, slates, large flint rocks, and feldspar. The flexibility of trucks hand-loaded at the mine face permits a daily blending of the total exposed deposit. A man is stationed in the storage bin to hand-sort the clay as a further check and to keep the feeder filled with clay.

Hydraulic mining, used in the old process, was discarded because clay-feed control could not be maintained. This has resulted in considerably increased mining cost, but there is no other alternative.

An ammeter is provided on the clay feeder to assure an even positive feed of clay into the pebble mill. Reagent is fed into the water entering the pebble mill under pressure by a piston-type pump operated by a water meter to proportion the reagent to the water used. The gravity of the reagent is checked hourly by a sensitive hydrometer. A quarter-horsepower propeller agitator is used to mix the concentrated reagent with water.

All water added to the clay is metered twice. The total flow is recorded by an orifice meter which is checked against four individual positive displacement-type meters, ranging in size from 2 to $^3/_4$ inch. All of the metering equipment is calibrated in liters to simplify the water-clay calculations as well as to make the control more sensitive. The pressure of the water, as indicated by a pressure gage, is maintained constant by a reservoir tank 60 feet above the plant, fed by a 2-mile flume line extending to the head waters of the mountain. Sediment separators with fine-mesh screens are located to catch any sediment not precipitated out by the settling chambers in the reservoir tank. Steam is injected into the main water line through a fine-mesh screen and is thermostatically controlled to maintain an even temperature in summer and winter. The correct operation of this phase is checked by a recording thermometer in the clay flow from the classifier.

A weighed amount of pebbles is added at definite intervals to keep the pebble charge constant as determined by a check of the pebble consumption made each time the mill is emptied.

Quick settle tests are run several times an hour to check the deflocculation. The settle test is

further substantiated by a recording p_H meter, which is sensitive to variations from the normal of clay feed, water, and to a slight degree of reagent, if insufficient. Baumé hydrometer readings of the classifier overflow are taken hourly and recorded.

Periodic tests are made of the underflow from the hydroseparators to keep them balanced with the inflow. Overload alarm equipment prevents damage to the equipment should human control fail. The overflow density of the slurry from the hydroseparators is indicated by sensitive hydrometers graduated in grams per liter. These data together with the volume of slip gives a means of calculating production.

Settle tests are periodically made of samples of slip from the hydroseparator overflow. The flocculating agent is weighed, mixed with a measured amount of water, and continually circulated by a small centrifugal pump operated by a float valve in the feed tank. The reagent is added to the clay through an interchangeable orifice to maintain a constant p_H as recorded by a second recording p_H meter. The hydrogen-ion concentration is checked also by colorimetric equipment as well as by a portable antimony electrode p_H meter. The most reliable control at this point is simply observation of the settle in a graduate, which is recorded each hour.

The specific gravity of the thickened slip pumped from the thickener is tested hourly and slip which is too thin is returned to the thickener. If the slip is too thick, it is thinned by metered water admitted to the suction line, thus maintaining a constant specific gravity for pressing, which is checked as the slip leaves the tank through the centrifugal pump on its way to be pressed. Thermostatic regulation of a steam valve into the slip tank keeps the temperature constant. The temperature is indicated by a dial on the thermostatic valve, which is occasionally checked against a mercury thermometer.

Any variations in the raw material are blended by the large size of the hydroseparators and the thickener, which has a storage capacity of 150 tons. The operations have been made continuous on a twenty-four hour day for obvious reasons. Further mixing and blending is obtained in the slip tank holding fifty tons of clay. This clay, as slip, is kept continually mixed by a 3-inch stream recirculating through the copper tubing to the pressure tanks and back to the top of the slip tank. When not pressing, the slip can be agitated by recirculating into the slip tank through two pipes and by discharging on each side of the top of the tank. The suction pipe extends to within six inches of the bottom of the tank which allows any sediment to settle to the bottom and be washed out when the tank is drained and cleaned.

Filter pressing is done on a definite time-pressure schedule by air supplied at a constant pressure from the receiver of the compressor. Any clay passing the filter cloths is returned to the thickener. Double chemically treated cloths and rubber gaskets are used in the presses. Weekly washing and airing of the cloths is practiced.

The drying is controlled with the aid of a temperature recorder and daily moisture tests of the clay. Further improvements in drying equipment are planned. The finished product is tested daily for dry shrinkage, dry modulus of rupture, residue on 325-mesh screen, viscosity, and drying behavior.

Regular tests are also made of the absorption, color, and firing shrinkage in an electric kiln fired under the same time-temperature schedule controlled by a recording pyrometer to cones 9 and 12.

The dry clay is tested at a centrally located laboratory where daily tests are also made of the clay refined at the other refineries.

V. Comparison of Old Process and New Process Clay

Table I represents the average of the laboratory records from September, 1935, to August, 1936, for the old process clay. The corresponding averages for the new process covers daily tests over a thirty-day period.

TABLE I

	Linear dry shrinkage (%)	Water of plasticity (%)	Dry modulus of rupture (lb./in.²)	Residue 325-mesh (%)	Cone 12 firing shrinkage (%)	Absorption (%)	Total shrinkage (%)
Old process	5.6	50	80	4.2	10.0	16.0	15.6
New process	4.0	44	119	0.6	10.9	11.0	14.9

The working properties of the new clay are considerably improved over the old. The "liveriness," formerly characteristic of North Carolina kaolins, has been entirely eliminated. The clay wedges well, cuts smooth with a 1-millimeter wire, and peels well from a plaster slab.

VI. Reserves

The area worked out during the past fifteen years covers five acres and represents an approximate tonnage of 50,000 tons of refined kaolin. The old process plant operated on a ten-hour day with a capacity of two tons per hour using a double washer.

There is still available in the same mine a tested area of a little less than six acres which, allowing 10% for slates and off-grade clay, would represent a clay tonnage sufficient to operate the new refinery for seven years at maximum capacity. The depth is conservatively estimated to be fifty feet.

In addition, within economic hauling range of the refinery, there is available a number of other mines, leased or owned, which have been prospected sufficiently to assure a supply of raw material, similar in character, for an additional period of twenty-five years.

This estimate is based on a recovery of 10%, which is seldom exceeded under present-day practice even at the old process plants. Sufficient data are not at hand to determine the recovery at the new refinery, but tests made at another refinery and confirmed by pilot plant tests of several weeks' duration, proved that the new process recovered as much clay as the old, even though re-refining the old process clay invariably eliminated a considerable percentage of residue. This recovery (compared to that reported by Watts[1]), of never less than 20% and as much as 40%, seems to indicate that the rich mines have been worked out.

Crude kaolin in the ground is assumed to weigh 100 pounds to the cubic foot with a moisture content of 15%.

Acknowledgment

The writer acknowledges the helpful assistance of the Tennessee Valley Authority, Ceramic Division, especially that of R. E. Gould, in solving the problems involved in this study and in providing access to the library of literature on North Carolina kaolins.

The Harris Clay Company
Spruce Pine, North Carolina

CONTINUOUS VERSUS PERIODIC FILTERING*

By G. G. Kent and E. M. Rupp

Abstract

Some of the problems encountered in continuous filtering for dry-pressed porcelain manufacture and their solution are discussed. A body consisting of 40% plastic material was used. A comparison of costs of two systems is also given.

I. Introduction

Previous to July, 1927, when a continuous filter was installed, four plate frame filter presses, having a combined capacity of 213 leaves, were in use. The cakes were 24 inches square and $1^1/_2$ inches thick and contained from 28 to 30% moisture. About three sets of presses were made in a single 9-hour day under normal conditions. The continuous filter installed in 1927 has an effective width of 10 feet. The diameter of the filtering drum is 9 feet and the diameter of the drier drum is 6 feet. The hourly production is higher than under the periodic system and the moisture content is more uniform.

II. Method of Operation of Continuous Filter

The continuous filter[1] comprises a large drum with wire mesh around the periphery to support the filter cloth, shallow compartments below the wire mesh from which the filtrate passes to a central outlet, a ring valve applying full and partial vacuum to succeeding compartments and breaking the vacuum on the compartment at the point of stripping, a vacuum pump and a means for rotating the drum at low speed, and a centrifugal pump for returning the water to the water-storage cistern.

The drier comprises a steam-heated metal drum rotated by means of closely spaced strings which wrap around both the filter and the drier drum.

In operation, the filter drum dips into a tank through which slip is pumped continuously, overflowing into pipes returning it to the storage cistern; the vacuum draws water out of the slip and leaves a thin cake on the cloth. As its moisture is drawn out, voids form in the cake and pressure is applied by a duck belt which covers

* Presented at the Thirty-Ninth Annual Meeting American Ceramic Society, New York, N. Y., March 23, 1937 (White Wares Division). Received March 1, 1937.

[1] Installed by Filtration Engineer's, Inc., Newark, N. J.

about one-third of the drum periphery. The cake is formed around the strings and has sufficient body to strip from the filter cloth when the strings are drawn off the drum.

The reinforced filter cake then passes to and wraps around the drier drum, making nearly a complete revolution before reaching rolls which separate cake from strings, allowing the strings to return to the filter and the cake to drop in flake form to a conveyer leading to the dust mill.

The operation is continuous when the proper rotative speed, vacuum, and drier steam pressure are determined. The vacuum held is 12 to 22 inches on compartments dipping into the slip and for some distance beyond and 22 to 23 inches on compartments covered with comparatively dry slip. Steam pressure on the drier drum is held at a point necessary to reduce the body to the required moisture content but does not exceed 40 pounds gage. A 2-horse power motor drives the filter drum through a Reeves variable-speed transmission at an average speed of less than $^1/_4$ revolution per minute. Water removed from the slip is returned for use in the next blunger mix to avoid loss of fine material.

Slip enters the filter with about 60% moisture and at a temperature of between 110° and 140°F; the reinforced cake between the filter and the drier contains approximately 25% moisture, and the flake leaves the drier with 14 to $17^1/_2$% moisture, depending on the type of ware to be pressed. The thickness of the cake varies from $^1/_{16}$ to $^1/_8$ inch.

III. Problems Encountered

The major problem was to obtain the required production from the filter because, in increasing the speed, the filter cake had a tendency to adhere either to the compression belt or to the filter cloth instead of to the strings.

This difficulty has been materially decreased by the following methods:

(*a*) *Lowering the Slip Level:* The slip level was lowered 15 inches by installing lower outlets in the filter tank.

(*b*) *Adjustment of Compression Roll:* Centered above the filtering drum is a heavy roll which rides on the compression belt. Better results were obtained by raising this roll so that the compression belt was not pressed so firmly on the cake.

(*c*) *Setting of the Ring Valve:* By changing the position of the ring valve, through which the filtrate passes, it is possible to control the point at which the vacuum is applied and where the vacuum is closed on the filter drum. In some instances, it has been possible to eliminate stripping by changing the position of this valve.

(*d*) *Changing Ball Clay:* This has been found to be the most effective method of decreasing or preventing stripping. Certain ball clays will work successfully on a continuous filter while others will not. This does not necessarily mean that only weak or lean clays must be used; for instance, stripping in one case was eliminated by changing from a weak to a stronger ball clay. It seems that a combination of ball clays gives the best results. It is possible to use a very plastic clay if at the same time a small percentage of less plastic clay is also used.

(*e*) *Variation in Vacuum:* Stripping as well as moisture content of the flake can be controlled to some extent by raising or lowering the vacuum during the period when the cake is being formed on the drum. A low vacuum results in a thinner flake, which is readily dried, while a high vacuum gives a thicker cake with a higher moisture content. The loss in production due to the thinner cake can be somewhat balanced by increasing the speed of the unit.

IV. Operating Data

The following operating data on the continuous filter for fourteen months are given:

Av. r.p.m.	0.234
Av. temp. of slip (°F)	125
Av. weight (oz./qt.)	45.12
Av. lb./hr.	2970
Av. operation (hr./day)	7.8
Max. production/hr.	3670
Min. production/hr.	2130

Comparative Data and Cost

	Continuous	Periodic
Floor space occupied (sq. ft.)	918	1689
Drying time (hr.)	Continuous	24–36
Men employed	1	5
Av. hourly output (lb.)	2970	2457
Maintenance and repair per year	$957	$1336
Power (h.p.-hr.)	23	15
Steam estimated per hour (lb.)	500	500

V. Summary and Conclusions

(1) The continuous filter can be used successfully for producing a body of from 14 to $17^1/_2$% moisture content if the plastic content of the body is around 40%.

(2) A more uniform moisture content can be

maintained and the desired variations in moisture content obtained.

(3) A saving can be effected by the continuous method of filtering.

Definite emphasis must be placed upon the fact that to operate a continuous filter successfully the body, in most cases, must be adapted to this method, especially with respect to the types of clays used.

SQUARE D COMPANY
PERU, INDIANA

PATENTS AND CERAMICS*

BY FULTON B. FLICK

ABSTRACT

This paper is directed chiefly to a discussion of the principles which govern the patentability of inventions in the United States. The various factors, such as invention, novelty, and utility are illustrated by examples directly relating to ceramic problems or by reference to court decisions involving patents in the ceramic field. A brief historical discussion of patent systems with facts bearing on the standing of ceramics therein is included.

I. Patents Are Private Property Rights

The Constitution of the United States provides (Art. I, Sec. 8) that

> "The Congress shall have power . . . . . to promote the progress of science and the useful arts, by securing for limited times to . . . . . inventors the exclusive right to their . . . . . discoveries."

This provision is unusual because it is the only instance in which the framers of the Constitution saw fit to vest Congress with the power of creating private property rights. You may ask why provision was made for granting to an inventor a species of monopoly when monopolies are ordinarily abhorrent to us.

At common law a person was entitled to his creations only as long as he kept them secret; once they entered the public domain, as by disclosure, publication, or use, they became public property. Under such a system there would be little incentive to an inventor to make his invention public. On the other hand, the progress of a nation is dependent upon continuity of invention. The framers of the Constitution evidently recognized, therefore, that it would be necessary to reward inventors if the country were to profit by their work. Hence the provision for a limited monopoly in return for a disclosure of one's invention. It follows that this provision was not for the benefit of the individual inventor, but rather that of the public at large, on the premise that the public would benefit by knowledge of inventions.

The industrial history of our country has justified that belief. Our patent system is one of the strongest in the world and probably the fairest to inventors. Our industrial progress has been inseparably attached to our patent system.

II. History of Patents

Patents were by no means new in this country. As early as the 14th Century, exclusive rights were granted to deal in various commodities, such as salt, paper, and other necessities. These became burdensome, and in England they were abolished in 1624 by the famous Statute of Monopolies. That statute preserved, however, the right to grant monopolies for limited times to inventors. Such patents had been granted theretofore, and it appears that during the 16th Century such patents had been granted on glassmaking.

The American Colonies were peculiarly dependent upon the development of industries, so they were dependent to a large extent upon invention, and here, too, patents were granted. For example, patents were granted for glass manufacture by Connecticut in 1747 and by Massachusetts in 1752. Strangely enough, despite its industrial importance, Pennsylvania granted no patents until it became a state after the Revolution.

The ceramic art has been inextricably associated with our patent history. In 1847 Edmund Burke,

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* Presented at the Thirty-Ninth Annual Meeting, American Ceramic Society, New York, N. Y., March 23, 1937 (Materials and Equipment Division). Received April 8, 1937.

our second Commissioner of Patents, published a list of the patents granted by the United States from 1790, when the first patent act was enacted by Congress, to 1847. During that period about 14,000 patents were granted. A scrutiny of Mr. Burke's report discloses the importance of ceramics in that day. Patents were then, as now, grouped in pertinent classes, and we find that there was a special class termed "Stone and Clay Manufactures," which included inventions pertaining to pottery, glassmaking, brickmaking, dressing and preparing stone, cements, and other building materials. In that period there were granted about 160 patents pertaining to brick presses, the earliest in 1792; 31 patents pertained to glass, 39 for cement, and 20 for brick and lime kilns. Various others pertained to glazes, firebrick compositions, and other phases of the ceramic arts.

Mr. Burke's book and early patents in general are worth study for they show that many of our ceramic developments thought to be radically novel are in reality the fruits of old concepts. In 1932, the Court of Appeals for the Third Circuit said [*Hartford-Empire v. Hazel-Atlas*, 59 Fed. (2d) 399],

> "Of all the major industrial arts, glassblowing has been the slowest to change from hand to machine methods. In the three hundred years following the bringing of the glassblowing industry to the United States by the Jamestown colonists and their building of two factories to make beads for sale to the Indians, there has been little, if any, change in the blowing of glass containers of any kind."

The implication is that machine blowing of glass is very recent, as indeed it is from the practical standpoint. Yet in the Burke book we find that in 1833 a patent for a *machine* for blowing glass was granted to Thos. Bakewell, of Pittsburgh.

Vacuum pressing of brick has been attracting investigation of recent years; yet it is disclosed in a patent granted in 1861 (No. 33,535). At present chrome-ore refractories are receiving attention, yet such refractories, specifically for furnace linings, were claimed in a patent issued in 1876 (No. 180,822). And the commonly used sodium-silicate bond was described in a brick patent as early as 1879 (No. 218,335).

The present system of numbering patents was instituted in 1836, since when more than two million patents have been issued. The earliest ceramic patent of this series that I have found was granted in 1829 and was re-issued in 1836 as patent No. 97. Interestingly enough, this patent was involved in litigation which went to the Supreme Court (*Wood v. Underhill*, 5 How. 1). The specification is admirably brief (22 lines) but it states the invention so adequately that the court sustained it against the defense argument that it insufficiently defined the invention.

Other early ceramic patents are interesting because, by comparison with present knowledge, they show how this most ancient of professions has in a few years passed from an art to a science. Number 99,267, of 1870, is for a roofing, to replace plaster, made from horse manure, clay, and glue. And a refractory is disclosed in No. 220,715, of 1879, as made from clay, ox blood, iron filings, salt, and cow hair.

The importance of ceramics in industry during our growth period is illustrated well by the early annual reports of our Commissioners of Patents. At one time these included reviews by experts of progress or knowledge in various fields. In the reports for 1849 and 1850, we find special articles on ceramics and on Chinese tilemaking, showing these to be important subjects.

III. Patentability of Inventions

Patentability of inventions in this country is governed by a statute (R. S. 4886), the pertinent part of which is as follows:

> "Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country before his invention or discovery thereof or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor."

This statute fixes the fields of patentable invention, namely, machines, compositions, manufactures (or products, so-called), and arts. The word "arts" as used in this statute has reference to methods, or processes. It fixes also the essential conditions precedent to the grant of a patent. First, the applicant must have invented something; second, it must be new; third, it must be useful; and, finally, it must not have been abandoned.

Taking up now the conditions which are fixed by the statute, the first is that that which is sought to be patented shall involve invention. Of the criteria of patentability, this is in many instances the most difficult to determine.

(1) Inventions of Things Not Preëxisting

Patentable invention means the provision through the creative faculty of something not existing before. Hence invention is not involved in the discovery of anything preëxisting, such as the discovery of a new law of nature or a previously unknown mineral. Such things have always existed even though not previously known or understood by man. It is the application of these things to the attainment of a useful result that is patentable, but the natural law or the mineral are not themselves patentable. Thus, Newton could not have patented the law of gravity, nor could the discoverers of kyanite, olivine, and other minerals patent them as such.

How then is one to determine whether an improvement on what has gone before differs sufficiently to confer patentability? Unfortunately we have no affirmative rule by which to determine positively the presence or absence of invention. This differs radically from the arts in which ceramists work, where there are available means for measuring the qualities with which the profession is concerned. We have means for measuring temperature, tensile and compression strengths, heat conductivity, petrographic data, and the like with certainty. There is, however, no arbitrary definition of invention which is applicable to all cases, as the courts have repeatedly stated, and we have, thus, no measure of invention in terms of absolute values. Instead, we rely on a set of negative rules to which the particular matter under consideration is subjected to ascertain whether or not invention is present.

One of the most important of these rules is that an aggregative association of elements is not patentable, *i.e.*, a patentable association of elements must result in a combination, not an aggregation. The antiquity of the separate elements combined is not material provided their association is novel and they coöperate, or combine, to produce a new and nonpredictable result or an old result in an improved way. We may call this the rule of additive results. If the result of the new association of elements is merely additive, it does not involve invention. If, however, the result is one which would not be expected, a patentable combination results.

To take an absurd example, an aggregation is the same as adding 2 and 2, the expected answer being 4. The rule of additive results applies—the association is not patentable. But if 2 and 2 coöperate in some manner to produce 5, a patentable combination would be present. To illustrate, assume that tableware had never been glazed, but that glazed roofing tile were old. It would not be patentable merely to glaze tableware because the result would be only that which would be expected. The application of the tile glaze to chinaware would be a mere aggregation because the result would be only additive, *i.e.*, tableware plus glaze would produce only the result to be expected by any one familiar with the art.

This rule of additive result, or if you prefer, of continuity of result, thus amounts essentially to this, that a mere change in degree is not patentable, while a change in kind is patentable. Patentable invention involves a discontinuity over preexisting knowledge.

A case in point is *Baker v. Kennedy Refractories Company* (253 Fed. 759). This involved a patent for a material for forming basic furnace linings. The claim covered fired dolomite in the form of granules substantially free from volatiles and ash and of uniform physical character. It was produced essentially by mere successive firings in cupola and rotary kilns.

The evidence showed that dolomite had been previously fired, either in cupolas or in rotary kilns, and had been used for patching furnace linings. On such a state of facts the normal conclusion would be, based on the rule of additive result, that the firing successively in the two types of furnace, previously applied *singly* to the same mineral, would not be invention.

But the court held the patent valid, for it was shown that dolomite had never been regarded as even a remote substitute for magnesite for this purpose, that the firing methods applied separately produced an unsatisfactory product containing ash and varying quantities of volatiles, and which, in addition to being nonuniform, slaked quickly. By the apparently simple expedient of double firing, using the known furnaces, there was obtained a product free from cinder and volatiles, and uniform in character. Thus it was unlike any dolomite theretofore known, and it was accepted as the equal of Austrian magnesite. Such fired dolomite sold at about $4.00 a ton, while Austrian magnesite sold for about $30.00 a ton. Based upon these facts the Court held the patent to involve invention.

As a further illustration, a patent application involved a hollow building tile of triangular cross-

section and provided interiorly with webs regularly crossing the open interior, and made in multiples or submultiples of one another in size. There was an earlier patent on a solid triangular building block made in multiples of a given size, and also one showing a hollow building block. Triangular section shapes, hollow and interiorly reinforced shapes, and the use of multiple sizes were therefore old. The structure was held to represent a mere aggregation of the earlier structures, the applicant having merely brought together separate elements without changing the function or producing any result other than the added result of the separate structures, and without producing any unexpected or novel product.

Allied with this rule, if not a part of it, is the rule that that which is the result only to be expected of the person ordinarily skilled in the art is not invention. The question is one of whether the creative faculty is involved, or whether there is involved merely the ability to be expected of one familiar with the art in meeting problems in his field by the use of known expedients in a known manner.

The question of expected skill is really one of ability to predict from what has been known. It is relatively simple in mechanical fields. For instance, if a nut slips on a bolt it would be merely mechanical skill, not invention, to key the nut on the bolt in the manner that gears and the like have been keyed on shafts from time out of mind.

Much greater difficulty is experienced, however, in chemical and ceramic fields, and the courts have recognized repeatedly that, despite the advance in the chemical and allied sciences, it is difficult to reason conclusively by analogy in those fields. In one case (*General Electric v. Laco-Phillips*, 233 Fed. 96) the court said,

> "Chemistry is essentially an experimental science, and chemical prevision is as impossible today, in spite of the accumulation of the great knowledge, as it was in former times."

Again [*United Chromium v. International Silver*, 59 Fed. (2d) 390], the court said,

> "But inasmuch as a chemical action is involved here analogy does not go a long way, because, while one can predict with confidence in mechanics in some instances, and in some cases where mathematics can be applied, in chemistry one almost entirely fails. In chemistry one can not anticipate a result. A result may be obtained only by experiment."

Many illustrations of this rule of obviousness or prediction of result could be adduced. As an example of interest to ceramists, Stowe patent No. 792,822 was held invalid on this ground (*Stowe v. American Refractories Co.*, 274 Fed. 241). The patent, issued in 1905, related to a process of making refractory magnesite as a substitute, apparently, for the Austrian mineral, by mixing ordinary magnesite with silica and iron oxide and calcining the mixture in a dry state in a rotary kiln. The American Refractories Company, when sued, proved in defense that the Harbison-Walker Refractories Company, finding itself unable always to get a satisfactory class of Austrian magnesite, had adopted as early as 1898 the practice of adding iron oxide to Grecian magnesite, which was similar to the Austrian save for a deficiency in iron. The mixture was then pulverized, moistened, formed into dobies, and calcined in ordinary brick kilns. That early practice was thus essentially like that of the patent except that the mix was wet and was calcined in a stationary kiln. The question, therefore, was whether it was an inventive change to substitute a dry mix and a rotary kiln for the Harbison-Walker practice. The Court of Appeals held that the person skilled in the art who was confronted with the problem would know that when mixing iron ore with magnesite he should obtain as intimate a mixture as possible, and he would be familiar with the fact that rotary kilns were commonly used for clinkering or fritting purposes. The court relied also on an early patent describing rotary kilns for calcining gypsum, lime, or cement which stated also that the material could be fed to the kiln either wet or dry. The court held, therefore, that wet and dry mixtures were equivalent in that instance, and that the rotary kiln was a full equivalent of the brick kiln theretofore used by the Harbison-Walker Refractories Company. Based upon this it was held that invention was not involved in the patent. Thus the alleged invention was the mere skill to be expected of one confronted with the problem of supplying a substitute for Austrian magnesite.

Another case [*In re Brotz*, 69 Fed. (2d) 111] involved a method of making vitreous enameled ware in which the metallic base was provided with a wet ground coat followed by a dry cover coat, both being fused in the same firing. It appeared that it was old to produce mottled ware with a single firing by dredging a dry contrasting enamel in patches over a wet ground coat. The claims were held unpatentable because there was no invention in merely making the cover coat continuous instead of mottled.

Again (*Young v. Burley*, 200 Fed. 258), the patent in suit was for a method of decorating pottery. It was proved that the precise method had been applied previously to heavier ware, such as crocks and water jars. In the language of the court, the only question was

> ". . . . . whether there was any invention in applying this same method to stamping more elaborate decorations upon smaller and thinner stoneware . . . . . "

Admittedly, the new use involved mechanical difficulties arising from the fragility of the ware. But the transfer of the method from thick to thin ware was an obvious one and the patent was held invalid.

In each of those cases the result was only that which would be expected, or predictable.

The change involved may actually be slight, but if it involves a change in kind (*i.e.*, discontinuity in, not an addition of properties), it is patentable. This is illustrated by a case (*Dunn Wire-Cut Lug Brick Co. v. Toronto Fire Clay Co.*, 259 Fed. 258) which involved a paving brick. Ordinary wire-cut brick had not been successful for paving because it was necessary to provide at least one of the vertical faces with small projections to space the brick laterally. Consequently all paving brick had been pressed. The invention was simple in the extreme; it involved merely providing the cutting edge with offset portions which would thus form ribs on a wire-cut brick. The claims in suit were attacked on the ground that there was no invention in making the cutting edge irregular. But it was proved that pressed brick were more expensive and less satisfactory than wire-cut brick and that the patented wire-cut brick had been accepted as better for paving than pressed brick. Furthermore, despite the known disadvantages of pressed brick, it had not previously occurred to any one to make this slight change in wire-cutting. On these facts the patent was held to involve "invention in no mean degree."

In all of these questions involving aggregation or mechanical skill and similar tests for the presence of invention, it is often most difficult to determine whether the alleged invention actually involved only what was to be expected. In such cases it is necessary to rely on ancillary factors. One such which is often used, and of major importance, is whether prior to the invention there had existed an unsolved problem or whether there had been a long and useless search for a solution.

In one case (*McCormick v. Medusa*, 222 Fed. 288), the invention had to do with a method of rendering cement waterproof. It was established by the plaintiff that for forty years prior to the invention various attempts had been made to render concrete less pervious to moisture; for example, it had been proposed to tamp the concrete in place to eliminate voids, to paint the surface of the concrete, or to treat it by applying materials which would close the pores. All of these previous proposals, however, were at best but partly efficient and provided no practical solution to the problem. In this state of the art, the patentee conceived that the reason why water enters the pores of apparently dense concrete is that it is drawn therein through capillary attraction. He proposed to render the walls water-repellent by the use of an insoluble lime salt of a fatty acid substantially free from water-attractile substances.

In the suit, it was proved that, prior to the invention, a process had been patented for the waterproofing of concrete by applying a solution of soap, followed by an application of alum, the idea being to precipitate an insoluble compound. In another patent, it was proposed to mix with the cement Japanese vegetable wax and caustic alkali. It was shown, however, that these procedures would provide glycerine, a definitely water-attractile material, or products soluble in water. Hence the prior art suggestions did not result in impregnating the pores with insoluble water-repellent material in accordance with the patent in suit. About the time suit was brought, the invention was being used to the extent of about one million pounds a year. While the step from using Japanese wax and caustic, or soap and alum, to that of providing substantially pure lime salt of a fatty acid is not great on its face, the fact that for many years there had been a continuous search for a solution to the problem and the further fact that no satisfactory solution had been provided, coupled with the fact that the invention had had great commercial success, swayed the court to hold the patent valid.

(2) Patentability of Function

Another rule relates to the patentability of function. It is the law that a function is not *per se* patentable. What is patentable is the provision of means for applying it to a useful purpose. A

classical example of this arose in connection with Morse's invention of the electric telegraph. Morse did not invent electricity; his concept resided in the use of electricity for transmitting intelligence, and he obtained a patent for his invention. Various claims of his patent were directed to the use of apparatus for performing his invention, and these were held to be valid. One claim, however, was directed to

"the use of the motive power of the electric or galvanic current, which I call electro-magnetism, however developed, for making or printing intelligible characters, letters, or signs, at any distance . . . . . "

It will be noted that this language is in substance a claim to the function of electricity for conveying intelligence to a distance. If held valid it would have covered any use of electricity for that purpose, whether by telegraphy as invented by Morse, or by wireless telegraph, then unknown, or by telephone. But being for a function and not including any tangible or concrete means for carrying that function into effect the Supreme Court held (*O'Reilly v. Morse*, 15 How. 61) that the claim was void.

The last of the more important negative rules to be considered here is that invention is not involved in merely substituting one material for another. This rule is based on the assumption that the new material acts in substantially the same manner to produce substantially the same result. An instance of the application of this rule is to be found in an old case involving a patent, the alleged invention of which resided in the manufacturing of door knobs from clay or porcelain. This case ended in the Supreme Court of the United States where the patent was held invalid as being for a mere noninventive substitution of material. The court observed that the sole novelty resided in the use of ceramic material instead of wood or metal, and further that the resultant knob still was nothing but a knob and that while the clay knob might be better and cheaper than metallic or wooden knobs, this result did not flow from anything new but merely from the fact that the clay or porcelain was better adapted to this purpose. As the court said:

"The improvement consists in the superiority of the material, which is not new, over that previously employed in making the knob. But this, of itself, can never be the subject of a patent . . . . . the difference is formal and destitute of ingenuity or invention."

An important exception to this rule arises where the substitution of a new material produces a new mode of operation, or provides the first practical success in the art, or gives more efficient action. In other words, patentable substitution of material involves the development of an unexpected property of the material which fits it for the use but which could not be predicted from the previous knowledge of the material. In a sense this involves a new use of an old article. If the new use is analogous to the old one, whereby the availability for the new use could be predicted, no invention would be involved.

A case (*Westmoreland v. Hogan*, 167 Fed. 327) illustrative of this point involved the simple concept of making saltshaker tops from celluloid instead of from metal or glass. The patent was attacked on the ground that this involved a mere substitution of material, a mere application of an old material to a new use. The evidence developed the strange fact, however, that celluloid was wholly different in character for this purpose from the materials previously used because it had the property of not attracting and retaining moisture, which property characterized glass and metal and explained why the openings in the old shaker tops clogged in damp weather. The celluloid top was free from that disadvantage. This property of celluloid was not known theretofore, nor predictable, so that the conception of making the top from this material was patentable on that ground and because it constituted the provision of a new and useful article.

As illustrative further of the application of this rule, in *Fry v. Rookwood Potteries* (101 Fed. 723), there was involved a patent covering the decorating of ceramic ware through application of the coloring matter by atomization, or spraying. The patent was held invalid because a prior patent disclosed the use of the atomizer for making paintings on canvas or paper or the like. The earlier patent did not refer to the application of colors to ceramic materials, but the court held that the transfer of this idea to the art of painting or decorating clayware involved no inventive use, on the ground that the two fields were analogous and nothing new was involved in the transfer.

These are some of the negative rules by which the presence or absence of invention is determined. There are others, but they are perhaps less met with in everyday occurrence.

(3) Invention Shall Be Novel

This brings us, then, to the second requirement for patentability, that the invention shall be new,

or, in patent terminology, that it shall be novel. In effect, what constitutes novelty is defined in the Statute itself, but while conditions are clear, there are important exceptions to each of them.

The first of the conditions is that the invention shall not have been known or used by others before the discovery of the same thing by the one seeking the patent. Such a use must have been in this country; a use in a foreign country, prior to the making of the invention by the applicant, is not sufficient to defeat patentability to him. Nor is foreign knowledge of the invention sufficient to bar the patent.

On the other hand, a use in this country prior to making the invention is sufficient even if that use was but by a single person, and even though the use was kept secret. But accidental and unrecognized use is not such a use as will bar a patent to one who subsequently discovers the thing and applies it to a useful end. In other words, novelty is not negatived by anything not designed or used deliberately to perform in accordance with the invention.

This may be illustrated by a case (*Libbey v. Mt. Washington Glass Company*, 26 Fed. 757) which involved a patent relating to the manufacture of glassware of mixed ruby and amber colors from the then known gold-ruby glass compositions, which are normally amber in color and require heat treatment to develop the ruby color. Prior to Locke's invention, these articles were reheated uniformly throughout to convert them uniformly to a ruby color. Locke's invention was predicated upon reheating only a portion of the article, or only isolated areas, to convert the reheated portions to ruby, the unheated portions remaining amber colored. The result was an article partly of amber and partly of developed ruby, the two shading into each other and producing beautiful and artistic effects. By the defense it was proved that, in the prior art manufacture of ruby glass, it was sometimes found that a portion of the article retained the amber color after heat treatment. The court said:

"But no one before Locke discovered that the gold-ruby compound could be so treated, and that it would produce an article so attractive in appearance. In the old process of making ruby-colored glass, it was sometimes found that a portion of the article, which had escaped in some degree the reheating process, retained the amber color. Undoubtedly this fact led Locke to his discovery; but, prior to Locke, any amber color in the ruby glass was considered accidental, and the article imperfect, and only fit to be broken up and remelted."

It was held that such accidental practice of the invention was not sufficient to defeat the patent because the accidental production of parti-colored glass from this material was considered to be an undesired result and no one had contemplated applying it to a useful end.

In the second place, novelty is absent if the subject matter of the invention has been patented or described in a printed publication prior to the invention by the later comer or more than two years prior to the filing of his application. A publication in the eyes of the law is anything printed, whether it be a description in a technical magazine, a newspaper, a catalogue, or a book. It should be noted here that, unlike prior knowledge and use, patenting or publication anywhere in the world prior to the discovery by the later inventor suffices to defeat patentability if the patent or publication is available before his invention or more than two years prior to his application. But the information available through a patent or publication must be full enough to put the average skilled worker in possession of the invention without exercise of his own inventive skill.

The next test of novelty is that the invention shall not have been in public use or on sale in this country for more than two years prior to the application. Note that, like prior knowledge and use, such use and sale must have been in this country. This is always a question of fact, but a single public use or sale in this country is enough to defeat the patent if completed more than two years ahead of the application.

It is held, however, that an experimental use, if made in good faith, to test the worth and efficiency of the invention does not negative novelty even though initiated more than two years prior to the application. The courts are, in general, quite liberal with regard to experimental use, provided it appears that the experiment was actually in good faith, because they take the view that successful patents are of more benefit to the public than those of little or no value and that, on this ground, it is desirable to test the invention prior to applying for a patent. In some instances some experimental uses must necessarily extend over a substantial period of time in order to thoroughly test the invention.

Probably the classic case (*Elizabeth v. American*, 97 U. S. 126) of this pertained to a pavement which had been laid for six years prior to application for the patent for the invention. In a suit

for infringement of the patent, this long use was set up as constituting a bar under the Statute we are considering. It appeared, however, that the inventor in perfect good faith had made that long use to make certain that his pavement was satisfactory and an improvement in the art, it appearing that at regular intervals he inspected the pavement and stated that he had laid it for experimental purposes.

On the other hand, an experimental use can not run on indefinitely. In *Egbert v. Lippman*, (104 U. S. 333), the invention involved a corset. Barnes, the patentee, presented a young lady with a pair of the corsets eleven years prior to filing the application for patent. She wore these for three years, and was presented with a second pair of corsets which she also wore for a long time. Later he married her. In holding the patent invalid, the court said:

> "We observe in the first place that to constitute public use of a patent it is not necessary that more than one of the patented articles should be publicly used. The use of a great number may tend to strengthen the proof of public use, but one well-defined case of public use is just as effectual to annul the patent as many. . . . . .
>
> "We remark, secondly, that whether the use of an invention is public or private does not necessarily depend upon the number of persons to whom its use is known. If an inventor, having made his device, gives or sells it to another, to be used by the donee or vendee, without limitation or restriction, or injunction of secrecy, and it is so used, such use is public within the meaning of the Statute."

Thus the court held that this was a gift, not for the purpose of experiment, and that, since the application was not filed within two years, it invalidated the patent. The case illustrates the point also that to constitute an invalidating use it need not be a use which is open and apparent to the public, since the corsets were not visible. It is interesting to note that one of the Supreme Court justices filed a dissenting opinion indicating that he was incensed by the thought that the lady's use of the corset could be considered to constitute a public use.

(4) Patented Article Must Be Useful

The third essential condition precedent to the grant of a valid patent is that the subject matter must be useful. This means that it must be capable of use or of producing a beneficial result. It need not function perfectly and may be capable of improvement, or it may work no better than a similar preëxisting invention, but if it meets the tests of invention and novelty still it is patentable.

On the other hand, the disclosure of the patent must possess some utility. The patent in suit in *Amer. Gas Accumulator Co. v. Prest-O-Lite* [9 Fed. (2d) 785] was for an absorbent mass for retaining acetylene in cylinders. The patent described a porous mass made from clay, siliceous earth, and charcoal. Experiments proved the futility of such a material for this purpose and the patent was held invalid.

(5) Invention Must Not Be Abandoned

The final essential to patentability is that the invention shall not have been abandoned. Abandonment under the Statute may be either actual, that is, intentional, or it may be constructive, that is, created legally. Either type of abandonment, however, will prevent the issuance of a valid patent. Actual abandonment is a deliberate abandonment of the invention, as by an express declaration. Constructive abandonment may arise, under the Statute, from more than two years' use or sale of the invention, the corset case being an example.

Or, constructive abandonment may arise from keeping the invention secret too long. Perhaps the leading case on this point arose in connection with a well-known alabaster glass. About 1903, the formula and process for making that glass were discovered. It was the most perfect diffusing glass produced at that time. Large quantities of the glass were made and sold during the succeeding ten years, but the formula and process were treated as secret inventions, no application for patent being filed and no information being available to the public. The invention was known to a trusted superintendent who later left the employ of his company and disclosed the formula and process to another. His former employer obtained an injunction (*Macbeth-Evans v. Schnelbach*, 239 Pa. 76) against the disclosure and use of the invention. The damage, however, was done for the information was then public. Thereupon the inventor applied for and obtained a patent on the formula and process.

In a suit under the patent (*Macbeth-Evans v. General Elec.*, 246 Fed. 696) the court held the patent to be invalid. The theory back of this is that, to use the words of the court,

> "the primary and dominant purpose of the patent laws is the public one of promoting the useful arts and sciences by bringing into general use discoveries which may be made from time to time by inventors."

Where an inventor makes a discovery and practices the invention secretly he is thereby acting in

derogation of the purpose of the patent laws by keeping the knowledge from the public. To obtain the benefit of the patent laws an inventor must therefore elect between secret practice, on the one hand, with possible loss of his right to a patent, or on the other hand of filing an application and obtaining a patent providing a monopoly in the invention for the statutory period of seventeen years. In connection with secret use we see, therefore, that the fact that the invention is not visually available to the public is not material, for in the corset case the corset was concealed by the clothing, and, in the alabaster case, the glass itself did not disclose how to make it.

There are other aspects of and exceptions to the factors governing patentability that have not been discussed, as well as other and distinct factors. Those considered herein are, however, perhaps the more important, and the ones most likely to be met in everyday practice.

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COWS AND CRACKS OR MEASUREMENTS OF THE STRENGTH OF GLASSWARE: THEIR DIFFICULTIES AND MEANINGS*

By Frank W. Preston

Most of the properties of glass can be measured on a piece of the glass and the measurements repeated, that is, they can be repeated on the same specimen and at the same part of the specimen. For instance, we can measure the refractive index of a piece of glass, and if we are not satisfied with the result we can repeat the measurement. If it differs by an amount beyond the experimental error to be expected, we may find that the second measurement has been made in a different spot on the specimen and that the refractive index varies little from place to place. By going back to the original spot, we shall usually obtain the original result.

Some properties to be measured are properties of the whole specimen, average values of the whole specimen, or average values of a track or path through the specimen or over its surface.

Thus the length, breadth, or mass of a specimen is a property of the whole specimen and not a property of part of it. The density of the specimen, as usually determined, is the average density of the whole specimen, and the density of one part may be different from that of another part. But though this difference of density may be measurable, it is, as a rule, measurable only when the parts have been separated, so as to give several small specimens in place of one larger one.

The refractive index, as determined in a spectrometer, is the average refractive index over a light-track through the specimen. The photoelastic constant is likewise the average constant over a similar light-track. Refractive index as measured in the refractometer is the average value over a substantial surface area.

Electrical conductivity is a statistical average of all the possible electrically conducting paths through the mass of glass connecting the electrodes. It is assumed that the resistance of the various paths is proportional to their length and inversely proportional to their cross-section. This is true, if true at all, only statistically, and probably only for zero current. When the current becomes great enough to have a measurable heating effect, the régime is unstable, and if the current tends to concentrate anywhere, that path's resistance drops and the concentration increases. At breakdown, virtually all of the current is concentrated in a narrow wormhole, and no meaning that is of interest can be attached to the term "electrical conductivity."

Again, the surface conductivity of many glasses greatly exceeds their body conductivity. It might be assumed that the surface conductivity would be the same all over the surface, but in practice conducting films tend to be reticulate rather than continuous, and certain minute channels may have a high conductivity and other channels may have a high resistance. The conductivity of the specimen as a whole can be measured, but it is apt to vary a good deal from specimen to specimen, and the same specimen will change from day to day, or during the continuance of the experiment. The experiment itself in fact may change the conductivity.

In "mechanical" testing, we find the same set of circumstances. We can measure the deflec-

* Presented at the Thirty-Ninth Annual Meeting, American Ceramic Society, New York, N. Y., March 24, 1937 (Glass Division). Received April 12, 1937.

tion of a beam under load, and from it we can calculate Young's modulus. This is the average value of Young's modulus throughout the stressed part of the beam; it is a *weighted average*, giving prominence to those parts of the beam that are highly stressed. The value of Young's modulus at the neutral axis, for instance, is immaterial. In the same way, we may determine Poisson's ratio, which is also a statistical average.

If we do not like the results, we can repeat them on the same specimen to see if we can get different results. The system is not harmed or changed in any measurable way by experiments on Young's modulus or Poisson's ratio.

The last statement is true of glass but is not true of certain celluloids and plastics. These materials flow even at low stresses, and are changed by the experiment; so is pure iron, and in fact most pure metals.

Returning to glass of the silicate persuasion and to mechanical experiments, the real difficulty comes in measurements of strength (as engineers have it) or cohesion (according to physicists). To measure strength, the strength must be overcome and the specimen destroyed. There are left two or more fragments, on which, theoretically, further strength tests may be made. But these will not be the same tests, because the strength must be tested at different places from the original place. Strength is not a property of the glass as a whole, but a property of certain weak spots.

The strength of a chain is the strength of its weakest link, and if we test a fathom's length of cable and the middle link breaks, further tests of the two yard-long fragments will not tell us anything about the strength of the original cable. In the same way, the test of the original fathom will not tell us the strength of a longer cable. The cable has to be tested as a whole. Further, the strength of one cable does not guarantee the strength of another one nominally like it. If we test a dozen cables, we may get rather widely varying results, so engineers allow a generous "factor of safety."

It will be evident, however, that if twelve cables give twelve different results, the divergences could be due, in fact would be due, simply to the divergencies of twelve particular links, *viz.*, those that broke. All the other links in all the cables could be identical, provided they were all stronger than the twelve.

It is clear enough that the resistance of glassware to electrical penetration and to mechancial failure is merely the resistance of the least resistant path. Further it is clear that the resistance of the path varies during the experiment. The path is not there before it is used; the path is created during the experiment.

If one attempts to drive cattle through bush country previously unused by animals of any size, the bush offers a certain resistance to their free passage. Open savannah forest may offer virtually no resistance; a New Zealand forest may be almost impassable or quite so; typical Pennsylvania second-growth is practicable in any direction, but only by picking a somewhat crooked track. The cows, urged on in the general direction, will pick the easiest-appearing ways, halting momentarily at obstacles and finally crashing through or circumnavigating them. Where one cow has gone it is easier for another to follow, and if there are enough cows, the last ones will move easily over a broken trail.

Now cows are only oversize electrons, and electrons follow a cow-track through a piece of glass. They explore a path for themselves, moving easily a short unencumbered distance, then halt momentarily at some obstacle, finally forcing their way in the right general direction, and wriggling through the thicket. The process has been watched in detail.

It will be quite evident that the resistance of a belt of thicket to a cow is not a property of the thicket as a whole. The resistance is not proportional to the depth of the thicket, or inversely proportional to its length, though if an infinite number of nominally similar thickets were available, that might be statistically true. The resistance of a thicket otherwise impenetrable is reduced to zero by one cow path, and a single English hawthorn hedge, five feet through, may hold up a herd of mad bulls, while a thousand times that depth of bush, with a thousand times the mass of trees, will be just a pleasant saunter for Bossie if she has a path through it.

Now suppose there is no path, but just a jungle, and we try to drive a herd of cattle through. If we drive the cattle frantic, they may break through a little quicker, but the thicket will offer much more resistance to them. If we take it easy, they will explore their way, and come through with little effort. The same thing is true of glass; if we give the electricity time, it will explore and construct an easy path. If we want instant results, the resistance of

the glass will be found to be much higher. Sustained loads get the results at lower specific pressures.

The same thing is true of mechanical loads. The way for glass to get rid of a load is to break under it and let the load fall. To form a break, a crack has to be started somewhere and propagated thence completely across the specimen. The principal question is, where it is going to start? After that, between which atoms or ions is it to be propagated at every stage? Matter is not a continuum, and glass is a particularly complicated discontinuum. All the high-silica silicates are bad in this respect, and glass is the worst of all. The individual units $(SiO_4)^{4-}$ are not plane structures, and they stick out across the track of the crack everywhere. They are made fast to other structures and to structures like themselves with powerful hawsers, running in every direction across the path of the opening crevice, and nowhere is there a cleavage or glide plane or other directing device. Given time, however, the crack, like the cow, will explore a reasonably easy path through the glass.

Examination of the "origins" of fractures almost invariably discloses a great deal of meandering on the part of the fissure at its inception. The blast that finally rips the glass apart is decisive and clean cut, like a stampede of cattle through an agreed path, but the first explorations are tentative and meandering.

I am not here proposing to go profoundly into the peculiarities of cracks or the fundamental physics of their propagation. From time to time I do that as new light focuses on the subject. In this paper, I wish merely, by analogy, to suggest why the formation of cracks, or the breakage of glassware, is subject to such large variations from specimen to specimen, even when the specimens are nominally alike, whereas other properties like density (mechanical or optical) are subject to far less variations.

The reason is, as above outlined, that density is a statistical average of a specimen or a zone or channel of the specimen, which includes, in every direction, vast numbers of atoms or ionic groupings. A crack is a property of the cohesion of individual atoms or ionic groups, and in one direction at least (crosswise of the crack) is not statistical. It is the strength of the weakest bond, not the average strength of many bonds, that is involved. The process of stretching a piece of glass to destruction does not dissolve all the stretched bonds, dividing the specimen into a vast number of laminae one atom thick; it merely dissolves those bonds that lie on a single crack.

To revert to the analogy of the bush: If we have a hundred acres of bush to cut down, and the bush is fifteen years old, and superficially similar all over, it will take just about as much effort to cut down any ten acres as any other ten. This is analogous to melting a piece of glass. Any piece of the same glass requires about the same amount of heat per unit volume to melt it.

On the other hand, if cows have to be driven the narrow way through this belt of bush, there may be one place, one block of ten acres, through which deer or pigs have made a trail, and that particular spot may be easy for the cows to open up and crash through, while all other acres are impenetrable.

The presence of the "pig trail" does not measurably affect the general density, or the cost of clearing the surrounding acres. It affects no property of the bush except its *resistance to penetration*.

BUTLER, PENNSYLVANIA

Forward-going aggressive ceramists succeed only by continually studying, not narrowly, but broadly the current problems in all ceramic fields.

ACTIVITIES OF THE SOCIETY

AUTUMN MEETING, ART DIVISION, SYRACUSE, N. Y., OCTOBER, 28–30

The Art Division of the American Ceramic Society is offering an unusual opportunity—two days of discussion of the practical problems of interest to the studio potter.

Through the coöperation of the Syracuse Museum of Fine Arts, these meetings will be held in the Museum's new quarters at State and James Streets, October 28–30.

The Mizpah Hotel will provide room accommodations at reasonable rates.

Those interested in ceramics as a teacher, connoisseur, hobbyist, or individual artist-potter, can not afford to miss this meeting

Thursday, October 28

Registration: Afternoon and evening at the Mizpah Hotel.

Friday, October 29

9:00 A.M.

"The Use of Plaster in Ceramic Art" by R. Guy Cowan, designer, and Martin Blundred, head moldmaker, of the Onondaga Pottery Company.

This discussion will concern tools, methods, and practice from the professional point of view and will deal with moldmaking both for pottery and ceramic sculpture.

1:00 P.M.

"The Potter's Wheel" by Thomas Parker, Wheeling, W. Va.

Mr. Parker is an outstanding professional thrower of more than thirty years' experience. He will talk on method and practice and will demonstrate his art.

3:00 P.M.

"Kilns and Pyrometry Equipment for the Studio Potter" by F. H. Norton, Massachusetts Institute of Technology, Cambridge, Mass.

Materials and construction illustrated by small models, drawings, and photographs.

8:00 P.M.

Reception at Museum.

At this time, R. Guy Cowan will present a review of the history and aims of the National Ceramic Exhibition, together with a juror's view of the current show.

Saturday, October 30

9:00 A.M.

"Bodies, Glazes, and Colors for the Amateur Potter" by Arthur E. Baggs, Ohio State University, Columbus, Ohio.

1:00 P.M.

A symposium on processes of ceramic decoration suitable to studio pottery production.

Important additions to the above program will be made later.

—CHARLES M. HARDER, *Chairman,*
Art Division, American Ceramic Society

ACTIVITIES OF COMMITTEE ON SECTIONS AND DIVISIONS

L. J. Trostel, J. L. Carruthers, H. E. White, and H. M. Kraner, met with Dr. Sosman at the recent meeting of the Refractories Division at Bedford Springs, Pa., to discuss activities of the Committee on Sections and Divisions.

The Committee agreed that it would be desirable if the Society were to allocate some funds to Sections so that speakers could be provided much more satisfactorily than is now done. At the present time, none of the Sections has sufficient funds to pay traveling expenses for speakers and the result is that the speakers who are obtained for the Section meetings are generally local talent and do not always provide sufficient variety to keep interest in the Section meetings. M. C. Shaw has offered to help in the coördination of programs for the Local Sections, and if funds were available for them to use in this manner, he, no doubt, could also arrange to obtain outside speakers and perhaps arrange a tour in special cases.

Another question was that of the future of the Terra Cotta Division. It seemed to be the opinion of those present that it would be desirable to combine the Terra Cotta Division with the Structural Clay Products Division.

If the Terra Cotta Division is combined with the Structural Clay Products Division, a way would be opened to the formation of a more or less technical division which might be called the Division of Physical Chemistry, which would logically take in the presentation of papers of general technical interest along these lines, and lighten many of our various programs to such an extent that such an arrangement would be a compromise with the proposal recently made by R. F. Geller. Mr. Geller has proposed to have our Annual Meetings divided into half-day sessions on technical papers and additional half-day sessions of general meetings in which papers of general interest would be presented. There seems to be some thought that if such a division were formed, at least one additional general session could be provided and at the same time this new division would handle papers of general technical interest without impairing the present divisional programs.

—H. M. KRANER,
Chairman, Committee on Sections and Divisions

A. E. BADGER TO GERMANY

A. E. Badger, Research Associate of the University of Illinois Engineering Experiment Station, who is connected with the Department of Ceramic Engineering, sailed on September 12 for Germany, where he will go to the Kaiser-Wilhelm-Institut für Silikatforschung at Dahlen.

Mr. Badger will be there on leave of absence from the University for a period of several months' work under Woldemar Weyl. The particular project in which he is interested is the coloration of glass by the use of vanadium and some other oxides.

In September Two and Thirteen Corporations and Personals Joined the Crew Sailing

GOOD SHIP CERAMIC PROGRESS

1937 MEMBERSHIP RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
December 20, 1937	1452	196				
January 20, 1937	1478	199				
February 23, 1937	1579	210	19	515	220	2543
March 29, 1937	1613	212	18	524	220	2587
April 23, 1937	1517	209	29	485	220	2460
May 22, 1937	1541	209	25	501	220	2496
June 22, 1937	1572	211	23	502	220	2528
July 20, 1937	1607	212	20	506	220	2565
August 23, 1937	1634	215	17	509	220	2595
September 23, 1937	1647	217	19	509	220	2612

Nine months of 1937 are passed.

Three months yet are ours to make a record in ceramic progress.

It is up to each of us to make this coöperative Society return to each of us the largest possible dividends in knowledge.

NEW MEMBERS

Corporation

ROCHESTER & PITTSBURGH COAL COMPANY, S. W. Guthrie (voter), Church St., Indiana, Pa.

Personal

BARDROF, FRANK E., 3068 Warrington Rd., Shaker Heights, Ohio; associate editor, *Glass Industry*.

*BUCK, KENNETH E., Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.

GARLICK, L. E., Primrose Brick Works, Primrose, Germiston, Transvaal, S. A.; managing director.

*HARDER, CHARLES M., Alfred, N. Y.; professor.

HEINZ, C. E., 2333 Wall St., Joplin, Mo.; metallurgist.

*HUGHES, ADRIAN C., Sales Department, Dixie Fire Brick Co., Inc., 823 Woodward Bldg., Birmingham, Ala.

ILIFF, JOHN W., 15401 Richmond Place, East Cleveland, Ohio; sales manager, Harshaw Chemical Co.

LOBAUGH, FRANK E., Box 556, Alfred, N. Y.; assistant professor.

MACDONALD, RONALD, Primrose Brick Works, Nigel, Transvaal, S. A.; clay works manager.

SHANOK, VICTOR, 309 Johnson St., Brooklyn, N. Y.; technical manager, glass laboratories.

SKIRBLE, WILLIAM H., 6630 Northumberland St., Pittsburgh, Pa.; advertising manager, Pittsburgh Crushed Steel Co.

SMALTZ, HUBERT J., 122 Jackson St., New Lexington, Ohio; assistant ceramist, Ludowici-Celadon Co.

SMITH, RICHARD W., 425 State Capitol, Atlanta, Ga.; geologist.

* STRUBLER, GORDON L., Corning Glass Works, Corning, N. Y.

TOWNSEND, JOHN R., 463 West St., New York, N. Y.; engineer, Bell Telephone Laboratories, Inc.

Membership Workers' Record

Corporation

Office	1		

Personal

Dwight G. Bennett	1	Robert B. Sosman	5
John T. Ogden	1	Office	8
		Grand Total	**16**

ROSTER CHANGES DURING SEPTEMBER

Personal

BARRETT, LIONEL R., Mellor Laboratories, Shelton, Stoke-on-Trent, England. (Watford, Herts, England)

DAY, RALPH K., 25 Linwood Ave., Buffalo, N. Y. (Corning, N. Y.)

FAY, MERVIN A., 511 W. Union Blvd., Bethlehem, Pa. (State College, Pa.)

FULLER, DONALD H., 6 Abernathy Dr., Trenton, N. J. (Hatboro, Pa.)

HESTER, WESTON, A. P. Green Fire Brick Co., 2842 W. Grand Blvd., Detroit, Mich. (Student, University of Illinois.)

HOSSENLOPP, A. M., General Ceramics Co., Keasbey, N. J. (Flint, Mich.)

MOULTON, D. A., 715 Mulberry St., Terre Haute, Ind. (Evansville, Ind.)

PEARCE, R. MELVILLE, Edison General Electric Corp., 5660 W. Taylor St., Chicago, Ill. (Schenectady, N. Y.)

PHILLIPSON, EDWARD G., Y. M. C. A., Room 68, Regina, Sask., Canada. (Flin Flon, Manitoba, Canada)

RUPRECHT, BERTRAM C., 6534 Rosemoor St., Squirrel Hill, Pittsburgh, Pa. (Wilkinsburg, Pa.)

REID, John O., Alfred, N. Y. (Jersey City, N. J.)

SMITH, PAUL L., National Bureau of Standards, Washington, D. C. (Student, State College, Pa.)

SOLOMON, ROBERT, Y. M. C. A., Muskegon, Mich. (New York, N. Y.)

SPENCER-STRONG, G. H., 4134 Westview Rd., Baltimore, Md. (Incorrectly changed to Sandusky, Ohio, in Sept. *Bulletin*.)

TARNOPOL, MILTON S., P. O. Box 413, Zanesville, Ohio. (Student, Mass. Institute of Technology)

WARDE, JOHN M., A. P. Green Fire Brick Co., Mexico, Mo. (Student, Montana School of Mines)

WILLACH, HEINRICH, Krauschwitz bei Muskau Oberlausitz, Germany. (Formerly in name of Kurt Dehne)

ZWETSCH, ARTUR, Flörsheim / Main, Mühlweg, Germany. (Ratingen, Rhld., Germany)

* Indicates former member of the Society rejoining for 1937.

DR. KONDO APPRECIATES HONORARY MEMBERSHIP

The Secretary of this Society has received letters from Seiji Kondo expressing his deep appreciation for his election to Honorary Membership in the American Ceramic Society. Dr. Kondo wrote from his home address, 109 Third Street, Den-en-chofu, Omori-ku, Tokyo, Japan, under dates of August 20 and 24, 1937.

"The certificate of Honorary Membership in your Society, signed by the General Secretary and President has been received. I thank you very much for sending it. I cannot sufficiently express my thanks for the trouble you have taken in recommending me for an Honorary Member of your Society.

"That I was elected an Honorary Member of the Society by unanimous vote of the Board of Trustees surprised me strikingly, since I had never expected such a thing. It is not only a great honor to me, but also to our ceramic department.

"Of course, I was congratulated by many friends as the event was reported in the *Journal of the Japanese Ceramic Association* and the weekly paper of our University.

"The Diploma, signed by you and Dr. Robert S. Sosman, is now the most precious treasure in my home and the most important ornament in my library, which has just been built with funds contributed by our ceramic people in commemoration of my twenty-fifth year of service in ceramic education."

—SEIJI KONDO

Membership in American Ceramic Society FOR CONTINUING EDUCATION IN CERAMICS

WALTER M. HUGHES IS ADVANCING

Walter M. Hughes has been elected Acting President of the S. A. Weller Company, Zanesville, Ohio. Mr. Hughes has been connected with the Weller Company since 1933, serving as Vice-President for the past three years.

Walter M. Hughes

Mr. Hughes was born in Zanesville, Ohio, March 23, 1902, and was graduated from Ohio State University in 1924, with the degree of Bachelor of Ceramic Engineering. He was connected with the American Encaustic Tiling Company in various capacities from 1924 to 1933. He received the degree of Ceramic Engineer in 1937.

CULLEN W. PARMELEE HONORED

C. W. Parmelee, Head of the Department of Ceramic Engineering, University of Illinois, has been notified of his election as an Honorary Member of the German Ceramic Society at its 1937 annual meeting held in Freiburg, Germany.

New Members joining during November, December, 1937, will receive the December Index Issues for 1937 as well as all 1938 publications.

FRANK E. LAYMAN DECEASED

The death of Frank E. Layman occurred at Middletown, Connecticut, on August 13, 1937. At the time of his death, Mr. Layman was Vice-President of the Sherka Chemical Company, Bloomfield, New Jersey. He had been with this Company since 1932, and previously was connected with the Cutler-Hammer Company, the Bakelite Corporation, and the Brunswick-Balke-Collender Company.

Frank E. Layman

Mr. Layman was born in Sandusky, Ohio, fifty-four years ago. He was educated at Ohio State University, graduating as a ceramic engineer in 1905. Mr. Layman had been a member of the American Ceramic Society since 1906.

ADRIAN HUGHES DIRECTOR RESEARCH

The Dixie Fire Brick Co., Inc., Birmingham, Ala., has acquired the services of Adrian C. Hughes, formerly Fellow in the Refractories Fellowship at Mellon Institute. Mr. Hughes will direct the installation of laboratory facilities at the Kimberly, Ala., plant and will supervise the control-testing system and research program, as well as the technical sales work throughout the southeast.

MICHIGAN-NORTHWESTERN OHIO SECTION

The early fall meeting was held in the Medea Hotel on September 24. Following a short business session, Mr. Hardy, of the Mount Clemens Pottery Company, introduced a friend of his, an Egyptian archeologist who gave an enlightening comparison of Egyptian and American ceramics.

The fact that the archeologist later turned out to be the local brew salesman did not detract from the success of the meeting. Thirty-one persons attended this meeting.

—L. G. TAIT, *Secretary-Treasurer*

ABSTRACT OF MINUTES OF ANNUAL MEETING OF FELLOWS OF THE AMERICAN CERAMIC SOCIETY

March 22, 1937, Waldorf-Astoria Hotel

The meeting was called to order at 4:10 P.M. by Dean Watts with thirty-two members present. The minutes of the 1936 annual meeting were approved as presented in mimeograph form.

The report of the Treasurer, showing a balance of $2763.79 as of March 15, 1937, was accepted.

No reports were presented by the Committees on Honorary Membership or Resolutions. A report of the Committee on Education and Publication was presented by C. W. Parmelee, approved, and filed with the complete minutes of the meeting.

Dean Watts presented a report on the activities of the Dean's office as follows:

(*a*) Biographical records of all but two of the living members of the Fellows have been assembled and will be bound and made part of the official records of the Society.

(*b*) Obituary records of the deceased Charter Members will be bound with the biographical records.

(*c*) Obituary records of Past-Presidents who died before the organization of the Fellows will be included with the records of the Charter Members.

Fellow Dues

Action on the resignation of a Fellow was deferred, pending consideration of the matter of Fellowship dues.

There was a lengthy discussion of dues and the purpose for which the Fellowship funds were collected. It was questioned whether the dues should not be abolished. The point was also raised that the payment of these dues detracted from the honor of Fellowship.

The question of dues was combined with discussion of the use of the funds so obtained.

It was shown that financial aid has thus been available for publications that might not otherwise have been possible, such as the phase-rule diagrams. The publication of additional phase-rule material as well as other material has already been approved or is under consideration.

It was thought by some that funds for such projects could be obtained by subscription or from the general Society funds when definite programs or projects were proposed and that it was not necessary to finance them through dues of the Fellows.

There was also the suggestion that, in order to provide additional funds for the special publications, a small increase might be made by the Board of Trustees in the general membership dues in the Society.

It was moved, seconded, and carried that the Fellows recommend to the Board of Trustees that the Fellowship dues of $5.00 per annum be abolished and that a place for subscriptions to the Fellowship fund be provided on the annual bill.

The question was raised whether or not Fellows would still be liable for unpaid dues to date. It was moved and seconded that recommendation be made to the Board that Fellowship dues in arrears be no longer charged and that all members of the Fellows be declared in good standing regardless of their status with regard to unpaid dues. The motion was lost.

Applications for Fellowship

Dean Watts presented the following recommendations from the Jury:

(*a*) The Dean notify the men whose applications for Fellowship are still pending that they have not been submitted in time for action to be taken and that these nominations be carried over for consideration in the coming year.

(*b*) Petitions should not be accepted for consideration later than six weeks before the Annual Meeting.

(*c*) A change in procedure for nominations be made as follows: (1) A man is to be nominated by an individual and six cosigners as at present, the nomination blank to be signed by the Division Chairman as at present. (2) The Dean will select a sponsor for the nominee who will accumulate data on the candidate's professional record. (3) The data will be submitted to the Dean who will pass it on to the Jury for action. (4) After the Jury notifies the Dean of approval, the Dean will notify the candidates that elevation to Fellowship will take place at the next Annual Meeting. At the same time the nominee will furnish biographical data. This scheme does not permit the prospective Fellows to know that they are being considered until after the Jury has acted.

(*d*) The Jury suggests that the Society accumulate professional records of all members of the Society.

There was considerable discussion concerning the number who should be raised to Fellowship in any one year. It was moved, seconded, and carried that the number admitted during the coming year be limited to ten and that a committee be appointed to study this question and report at the next Annual Meeting.

Dean Watts announced the election to Fellowship of the following ten men: Gordon Fulcher, Douglas F. Stevens, B. J. Sweo, Herbert D. Carter, W. Raymond Kerr, Fred H. Norton, Stephen M. Swain, Gordon Wilkes, John F. McMahon, and Harry Ebright.

Other Business

Dean Watts suggested that, inasmuch as there were still more than 500 copies of the original phase-rule publication on hand, the additional material be published in *The Bulletin* with an extra number to equal this present stock and that the entire compilation be republished in the new format when this stock is exhausted. He further suggested that $1200 be appropriated at this time for the publication of the new diagrams.

It was moved, seconded, and carried that the Fellowship ear-mark $800 for publication of the new phase-rule diagrams, having in mind the ultimate publication of the entire series. (This, with $300 appropriated last year, makes a total of $1100 for this purpose.)

On motion, the question of publishing the bibliography of the works of Henry LeChatelier was referred back to the Society, inasmuch as this does not fall in the field to which the Fellows are committed.

It was moved, seconded, and carried that a bibliography on glass decolorizers, prepared by F. C. Flint, be published by the Fellows.

On recommendation of the Committee on Publications

and Education, it was moved, seconded, and carried to approve the proposal to join with the A.I.M.M.E. in the publication of a bulletin for distribution to the high schools in which the field of ceramic engineering and technology would be described. The question of paying for this publication from Fellowship funds was referred to the Executive Committee of the Fellows.

Moved, seconded, and carried that publications financed by the Fellows be uniform in size and style with *The Bulletin* and that they be free from advertising.

The following officers for the ensuing year were declared elected and were installed.

Dean: EMERSON P. POSTE
Associate Dean: LOUIS NAVIAS
Secretary-Treasurer: RALPH K. HURSH

REFRACTORIES DIVISION NOMINATING COMMITTEE REPORT*

The undersigned, constituting the Nominating Committee of the Refractories Division, nominate for officers of that Division for the year beginning in April, 1938, the following:

Chairman: Nelson W. Taylor, Department of Ceramics, Pennsylvania State College, State College, Pa.
Vice-Chairman: S. F. Walton, Exolon Company, Blasdell, N. Y.
Secretary-Treasurer: J. B. Austin, Research Laboratory, United States Steel Corporation, Kearny, N. J.
Committee on Nominations: R. E. Birch, Harbison-Walker Refractories Company, Pittsburgh, Pa., and H. M. Kraner, Bethlehem Steel Company, Bethlehem, Pa.

—ROBERT B. SOSMAN and R. E. BIRCH

* Received September 27, 1937.

WOULD YOU PAY

(1) $4.17 for a report of original research?

In 1936, the American Ceramic Society published 100 such reports, several of which were worth to you many times $4.17 per report.

(2) $4.17 for an abstract of an article?

In 1936, the American Ceramic Society published 4953 Abstracts, many of which were worth this $4.17 to you.

(3) $4.17 for a share in an organized promotion of ceramic education and research?

"Yes, sir!" is the answer to each of the questions by more than 1800 persons. Their judgment, singly and combined, can not be wrong.

These sums total $12.50, a total membership dues in this coöperative Society.

Valuable Bibliographies, a complete Ceramic Book List, and a Supplement to the Equilibrium Diagrams are in preparation, in addition to the regular monthly publications.

C. M. NICHOLSON

C. M. Nicholson has been appointed as ceramic engineer to the Canadian Nepheline, Ltd., of Peterborough, Ont.

C. M. Nicholson

He was graduated in ceramics from Saskatchewan University in 1930. He was affiliated with the Department of Highways of Saskatchewan for a short period, and on completion of the work involved, joined the temporary staff of the Dominion Fire Brick Co., Claybank, Sask. Following this, he was chemistry instructor with the Scott Collegiate, Regina, Sask., and, at the time he resigned, held the appointment of head of the Science Department.

Mr. Nicholson is a member of the American Ceramic Society and is the Canadian Nepheline, Limited, Corporation Representative of the Canadian Ceramic Society.

WHY NOT WEAR THE SOCIETY KEY ?

THIS YOU OWE TO YOURSELF

WHY CERAMISTS WILL GO TO NEW ORLEANS FOR THE FORTIETH ANNUAL MEETING

You have made plans to visit a number of interesting places in and near New Orleans during the Annual Meeting of the American Ceramic Society in March, 1938. Being interested in ceramics, you will want to visit some of the museums to get ideas regarding types of porcelain and glass used by the early settlers and to compare these with contemporary articles.

The types of pottery and glass brought to New Orleans in the early days were definitely French. These French porcelains and other ceramic products have had a great influence on the taste of the New Orleans people. It is stated that there is little evidence of early American or contemporary American ceramics in the homes in New Orleans today. This suggests an unusual opportunity for the American producers of various types of ceramics to cultivate the great potential market of New Orleans with their ware. Surely, this is an opportunity which should not be overlooked, an opportunity which obviously is not limited to various types of contemporary American pottery but can be made to include tile of all types, glass tableware, porcelain enamel in its various ramifications, and other types of ceramics.

If the people of New Orleans and vicinity are to be made aware of the excellent designs and usefulness of American pottery and other ceramics, it becomes an opportunity for the members of the American Ceramic Society to influence the New Orleans public with respect to American ceramics. The Fortieth Annual Meeting in New Orleans will exert a considerable influence on the taste of the people of New Orleans concerning American ceramics.

The general and technical sessions promise to be as interesting and as informative, if not more so, than at previous Annual Meetings. This is particularly true regarding the ceramic raw materials of the South, which are varied and extensive. The southern members will be glad to tell you about the ceramic raw materials, and no doubt arrangements can be made to see many of the mines and mills producing raw materials. A trip to the Crescent City Pottery works, to the Newcomb Pottery, and to other industries will prove interesting.

The Freeport Sulphur Company is producing in Plaquemine Parish, about fifty miles from New Orleans. The Jefferson Lake Oil Company is domiciled here, but is not now producing sulfur in the State. Chalmette, Pan-American, Shell, and Standard Oil Refineries are in this area and Texaco, Gulf, and Sinclair have producing wells.

The sugar refineries are the American and the Henderson in New Orleans; Godchaux at Reserve and Raceland, Colonial at Gramercy, and the Sterling at Franklin.

Among the chemical plants are Bay Chemical Company, which produces muriatic acid and salt cake at New Iberia;[1] Swift and Company at New Orleans, sulfuric acid; and the Hercules Powder Company at Westwego, alum and rosin sizing.

The Mathieson Alkali Works secures calcium carbonate for use in the production of lime from the oyster shells that are available in practically unlimited quantities from the dead beds in Calcasieu Bay and nearby gulf beds. The salt used by the Mathieson Company in the production of soda ash and caustic soda is found about twelve or fifteen miles from Lake Charles, Louisiana. Lake Charles is the site of the large and modern alkali plant using the ammonia-soda process for the production of soda ash and other alkali compounds. The soda ash is an important ingredient for use in the manufacture of glass and finds a market with the glass plants located in Louisiana, Arkansas, Oklahoma, and Texas.

The large paper companies are Bogalusa Paper Company, Bogalusa; International Paper Company, Bastrop; Brown Paper Company, Monroe; Southern Advance Paper Company, Hodge; and the Calcasieu Paper Company at Elizabeth.

—V. V. KELSEY

[1] See *Bull. Amer. Ceram. Soc.*, **16** [9] 381–83 (1937).

J. M. McKINLEY GIVES REASONS FOR NEW ORLEANS AS FORTIETH ANNUAL MEETING CITY*

My reasons for favoring holding the Fortieth Annual Meeting of the Society in New Orleans may be summed up in the following paragraphs:

The distance is nominal. Many of us live and work in fields that are entirely too narrow. Getting out of them once in a while may not appear desirable at first thought, but the reactions are always beneficial. If the reasons I give below for the New Orleans Meeting are sound, they would justify a winter meeting in Quebec.

This is a very large U. S. A. All of us are deeply involved in the effects of current issues. These issues will not be defined in terms of opinions or facts in Cleveland or Pittsburgh or Detroit. Most of us believe it would be exceedingly unfortunate to have them settled in such centers as those in which most of us work. I have gotten enormous benefits from a trip to Denver, for example, because I found people holding other views than those most common on the streets in Cleveland. The same is true in New Orleans, which is the "pulse" of a great part of American social as well as economic life. If the American Commonwealth is to be spared serious trouble due to certain concentrations of population, it will be because of the sanity or stubbornness (or both) of the hinterland people.

The climate of New Orleans is an agreeable change. The food is quite different and some of it is distinctive. I prefer to enjoy my meals at a Meeting.

The American Ceramic Society will prosper in proportion to the amount of its technical vitality. Our Meetings will improve in proportion to the extent to which we are able to obtain a "neutral atmosphere" in our surroundings at these Meetings. New York was a nervous, overwrought

* Received August 29, 1937.

sales-minded Meeting in a hectic hotel. If, as many of us believe, these Meetings are held to afford a wide personal exchange of ideas, then the New York Meeting was a failure. I'd rather have one hundred of our members exchanging views in a leisurely way at a Meeting than one thousand in a stampede.

Anyway, I like New Orleans. It seems to relieve the nervous tension.

—J. M. McKinley

WHY RHEAD IS FOR NEW ORLEANS

When you wrote for reasons why we should go to New Orleans, I was not inclined to give this serious consideration because there were so many obvious reasons why this was a desirable spot.

But on second consideration, I thought of your interest in the matter, and the tremendous job you have every year, and the beautifully smooth functioning of all these Meetings, which too many of us have come to accept as a matter of course. While these Meetings become larger and more complex every year, they are so beautifully managed that the average member is not conscious of the amount of work involved.

If any one should object to the location, or have any reservations, surely you should be the one. And if you are so willing and eager to make the Meeting the success it ought to be, there should be no reservation in the mind of any other member.

I voted for New Orleans because I thought we ought to go there. I have voted for New Orleans for the past four years. I am tired of the same old industrial centers with the "knee-deep-in-snow" climate. I don't like ear muffs, woolen neck rags, overshoes, or red flannel underwear.

I shall never forget the Atlanta Meeting, which incidentally was one of the most successful Meetings we have had, and while we were down there wondered why we should pick some industrial location every year when most of us are fed up with this sort of thing by force of circumstances.

If I had my way, we would charter a boat and go down to Bermuda or some such place. We could have our sessions on the boat and relax under decent conditions in between, returning far more rested and fit than when coming back from a Meeting held in a place which we are all acquainted with and which is merely a convenience for half a dozen or so members.

This plant visiting en masse is bunk and a waste of time. Any official or executive in *about any* organization can visit *about any* other organization under more favorable conditions *about any* time this is necessary or desirable. I know of no modern plant possessing anything worth seeing which will close its doors to the executive or official of another high-grade organization, and I know of no official of such organizations who will not encourage his staff members to visit other plants when this is possible or desirable. We do not have to wait for our Annual Meeting.

Likewise this reservation with regard to added time and expense is just another coddled prejudice which should be exploded forthwith. We have to go somewhere and some of us each year must necessarily travel farther than others. In course of time the thing evens itself. Short of going to New Zealand or Timbuctoo every year, and no one has suggested these places to date, I would say that the individual who objects to going to New Orleans, or who objects to his officials going to New Orleans, is among those who may be classified as a perennial grouch or as an inefficient handler of his own affairs or of his officials.

No one is so important that they can not be spared an extra day, and few efficient executives there are who could not and would not cheerfully and ably make up this time on their return. Unless you are a last year's "bird's-nest," you don't hire a man by the minute, you hire him to do a certain job which must be done regardless of the clock.

And those few extra dollars! I heard one conscientious objector discussing this subject while cheerfully and casually stoking away quarters by the dozen in a slot machine. Of course there are many younger members who can not afford any trip beyond a certain distance, but there can be very few who could possibly be affected by the difference in distance and consequent expense between New Orleans and, say, Chicago, New York, Detroit or Toronto. It all depends on where we live, and it will always depend on where we live.

Provided the facilities are there, and you and the Trustees will take care of that, I feel that the New Orleans Meeting will be one of the most successful and enjoyable to date and that there will be a return Meeting in due time.

Cordially,

Frederick H. Rhead

St. Peter Street, New Orleans

Along St. Peter Street in the New Orleans Vieux Carré is to be found the atmosphere of old France and old Spain. Note the light standards, copied after the original oil lamps, and the iron balconies of sundry design which are so typical of this part of New Orleans.

The building in the left foreground is Le Petit Theatre du Vieux Carré, organized in 1919 and now enjoying an enviable reputation.

The building in the right foreground is the Spanish Arsenal, erected in 1839 on the site of the original arsenal which was erected in 1770. The arsenal is now the repository of war relics, paintings, and kindred exhibits of the Louisiana State Museum.

Hundreds of historic buildings remain in the Vieux Carré to tell their colorful stories of the days of long ago.

Plan to Attend Annual Meeting
New Orleans, La.
March 27–April 2, 1937

THE ARCHITECTURE AND BUILDINGS OF NEW ORLEANS

No other city in America is like New Orleans.

With almost mystic reverence, New Orleans has preserved, unchanged, the ancient charm of its old city—the Vieux Carré, with its setting and shadows of the Pirate Lafitte, Andrew Jackson, Lafayette, the Casket Girls, Napoleon, and the heroes of Hearn, Cable, Grace King, and O. Henry.

And yet, if you step across the glittering expanse of Canal Street, America's widest business thoroughfare, you see skyscrapers of steel and stone standing on piling driven into ground that once gave life to cypress trees. You are in the hum of commerce and the roar of traffic fully fitting the South's greatest city.

The story of New Orleans is the story of a city with two personalities. Here the visitor finds the scenes of two centuries ago contrasted with the modern skyscrapers and factories of the present day. He finds many vestiges of the city that Bienville built in 1718 lying in the shadows of the modern buildings that the *new* New Orleans has built. It is just this happy mingling of the old and the new that has won for New Orleans the title, "America's Most Interesting City."

The Vieux Carré, which means "Old Square," touches Canal Street through a large part of its commercial section. In it can be found mingled beauty, history, and romance—scenes and settings that can not be found anywhere else in this country. It has the atmosphere of old France and old Spain. When you see the old buildings, the distinctive architecture, the curious courtyards, the narrow streets, the iron lacework, and the iron-trellised balconies, you feel that, indeed, you are in another world.

The heart of the Vieux Carré is the Place d'Armes, which later became known as Jackson Square. In this old square in 1769, the flag of Spain displaced that of France; in 1803, the flag of France displaced that of Spain; and in the same year the Stars and Stripes went up to stay.

The hoary buildings that throw their shadows on the old square were associated with the great events in this history of New Orleans. Foremost among them is the Cabildo. The transfer of Louisiana from Spain to France and from France to the United States took place there. It now houses the interesting exhibits and library of the Louisiana State Museum.

Flanked by the Cabildo is the St. Louis Cathedral which was built in 1794. In the crypt of the old church, still in use, are the tombs of many men in history.

The Pontalba buildings on two sides of Jackson Square once were sumptuous apartments. They were built by the Baroness Pontalba. They impress the visitor because of their spacious verandas and the elegance of the tendril-like ironwork display which has frequent repetitions of the interlaced initials of the families of Almonaster and Pontalba.

Just off the east corner of Jackson Square is the French Market which enthralls because of the many nationalities found there, the quaint dress, the varied languages, the stalls with their picturesque array of fruits and vegetables, meat and seafoods, and coffee shops.

Outside of the Vieux Carré, visitors find peculiar interest in the port, the industries, Lake Pontchartrain, the Shushan Airport, the water-purification plant, the Bonnet Carre Spillway, the Chalmette battlefield and the Pakenham oaks, the Mississippi River Bridge, the antebellum homes in the Garden District, the cemeteries, and numerous other places.

NEW ORLEANS LAKEFRONT DEVELOPMENT

New Orleans now has a new 40-million dollar front yard which is about ready for development int one of this country's finest residential and resort sections and waterfront playgrounds.

The city's northern boundary extends to the middle of Lake Pontchartrain which, after the Great Lakes, is the largest inland lake in the country. It is a salt-water arm of the Gulf of Mexico. Twenty years ago, the shores of the lake were lined with marshes and deforested swamps, with clumsy, fragile fishing camps jutting out into the water. Today the marshes and the fishing camps are gone and in their place are to be found new land, wide concrete roads, parks, and buildings.

Naturally enough, an initial step in this huge project was the construction of a seawall to act as a bulwark against the impinging waves from the lake when strong winds blow. The seawall was built in 1930 at a cost of $2,640,000 and is five and one-half miles long.

Then, powerful dredges began to pump in 35-million cubic yards of sand from the lake bottom to fill in the lakefront stretch, a reclamation project that created about 2000 acres of land. A total of six million cubic yards of material was also pumped from the lake to create land for the Shushan Airport.

In 1933, the federal government became identified with the project, clearing and levelling the made land, putting in water lines, building driveways, creating parking areas, and landscaping the area on an immense scale as part of the Emergency Relief Program. The various relief agencies of the government also improved the 1100 acres added to City Park and extended it to the lakefront, raising the ground, building driveways, miles of lagoons, and many bridges.

The bulk of the 2000 acres of man-made land will be divided into 1200 lots. These lots will be sold by the Orleans Levee Board, an agency of the State, to persons who agree to erect homes on them within three years from the date of purchase. Lots are being so laid out that no two houses will face or be close to each other. Each house will face the open area of the opposite lot and children will be able to walk to school without crossing the street.

A wide scenic highway now skirts the lake end of the development project. Parking areas have been created for bathers from the city proper, shelter houses have been erected, and this section, only five miles from the heart of the city which only a few years ago was a troublesome waste, already has taken on some of the beauty which the next few years will bring to it in full measure.

COMMUNICATIONS—CERAMIC HISTORY

ECKARDT V. ESKESEN

By Peter C. Olsen

Eckardt V. Eskesen was born in 1868 on the west coast of Jutland, Denmark, out where the heathers bloom and the roar of the North Sea fills the silence of the night—windy, windy out there; the few trees which can face the strong west wind are no taller than the low, thatched houses.

The Danes being a seafaring nation, Mr. Eskesen's father in early boyhood went to sea and, by many adventures, gained the reputation of being a daring sailor. The name Eskesen was, therefore, well known on the west coast.

This was in the days before the appearance of the steamer, when sailing vessels were at a price. The elder Eskesen in time became the owner of a two-masted schooner with which he plied the Baltic, the Atlantic, and the Mediterranean and sailed in a nice fortune. After marrying, he settled down as a landowner.

The family, however, grew larger and larger—on came one child after another till there were twelve in all. The home became too crowded for little Eckardt or perhaps he, like his father, wanted to be independent, and he decided early to try to shift for himself.

In winter he attended the little country school, and he hired himself out on neighboring estates in the summertime. The schooling was thorough enough, though sparse; he was chiefly interested in arithmetic, history, and geography. But what he missed in his school days he has since, with his hunger for knowledge, made up by self study, by reading, and by traveling.

Because he left school early in spring, before the end of the term, he never got up before the examination board. In fact, he admits the unusual fact that he, not having had the means or time to go through a college or take a course at an institute of learning, has never faced a board of examiners and has never been presented with a diploma.

He had a longing to get out in the world and, as a means to this end, he took up the study of languages. He got along well in English and German with a private tutor. Later on he studied the Latin languages.

When he was about fifteen years of age, it came to his knowledge that a position was vacant in a nearby city as correspondence clerk with a large pork-packing and exporting house doing business with England. "E. V." applied for the job and got it, somewhat to his own surprise. The manager of this international establishment must have had ideas of his own, since he selected the little boy fresh from the country in preference to the hundreds of boys of the town with college and high-school education who eagerly applied for this position.

At the age of twenty-three, after having held several clerical positions in Denmark, he decided to emigrate to America. Three brothers and a sister were already there and doing well in the terra cotta industry.

He arrived in New York one April morning in 1891 and went through Castle Garden. Being short of funds, he immediately went with a brother and applied for work at the old New York Architectural Terra Cotta Works, Long Island City, and got a job as presser.

For three and one-half years he worked in different terra cotta plants, determined to learn the business from the bottom up. It was hard manual labor, with no leisure or recreation. After the day's work, he went to evening school to study languages, business accounting, etc., sometimes attending two schools in one evening.

His brother-in-law, Karl Mathiasen, together with another brother-in-law, at that time had started a factory for manufacturing terra cotta on a small scale at Perth Amboy, New Jersey. The concern was later incorporated as the New Jersey Terra Cotta Corporation.

In 1894, Karl Mathiasen offered Mr. Eskesen a job as clerk-in-general in the new Company. Mr. Eskesen was glad to accept the position at $6.00 a week (and unlimited working hours).

It was now steady forward going. Mathiasen and Eskesen spent many happy years in work together, seeing the Company grow from a one-kiln plant to one of the largest in the industry in the East.

In 1897, with two brothers and another brother-in-law, he became a stockholder in the Company. When Karl Mathiasen died in 1920, E. V. Eskesen became its President.

The New Jersey Terra Cotta Company was essentially a family affair, as was the Matawan Tile Company, which was started in 1904 by the same interests to manufacture floor tile.

Later a consolidation was made with the South Amboy Terra Cotta Company and in 1928 the Federal Seaboard Terra Cotta Corporation was formed by the merger of three companies, the New Jersey Terra Cotta Company, the Federal Terra Cotta Company, and the South Amboy Terra Cotta Company. Eckardt V. Eskesen was elected President of the new Company.

E. V. Eskesen, during forty-odd years of work in the industry, has seen the terra cotta as well as the ceramic industry in this country grow from a rather primitive beginning to a highly scientific and systematized business. Colleges and schools of learning in ceramics have, during this period, been founded all over the country.

Mr. Eskesen, during the term 1931–1932, served as President of the American Ceramic Society.

He was President of the National Terra Cotta Society 1924–1925. One of his accomplishments during his term was the publication of a large textbook with pictures illustrating terra cotta of the Italian Renaissance.

Eckardt V. Eskesen is not only a practical man, making of Jersey clay those beautiful façades lighting up our "Main Streets" but also, as most of us do not know, he is a

poet and writer in his spare time. His writings have been chiefly in the Danish language; in 1904 he published a volume of poems in Copenhagen entitled Toward the Light. This was well received and had in it evidences of a promising future. Though he has not lately kept up his literary pursuits, he still is a lover of the classic and a friend of many of the poets of the decade.

During all these years, Mr. Eskesen has kept in close touch with his mother country. He is recognized by his countrymen here as an active worker who aims to keep the best of Danish culture alive in America. He has been instrumental in establishing cultural intercourse between America and Denmark by the exchange of students, professors, lecturers, and artists.

In appreciation of his many services, the King of Denmark in 1912 created him a "Knight of the Danish Flag."

Mr. Eskesen has done a lot of traveling; he has visited every part of the United States, as well as Canada and Mexico, most of the time by automobile. He has been in Europe many times roaming around, spending weeks among the ruins of Italy, its mountains, and lakes. He loves to study the people and their customs and talk their language.

KARL MATHIASEN

Born in Jutland, Denmark, in 1860, Karl Mathiasen came to the United States with his father in 1873. His mother came a few months later with the other children and the family settled in Perth Amboy, New Jersey.

Karl Mathiasen started work in a local cork factory and later worked in the pressing department of the old Perth Amboy Terra Cotta Company, known as A. Hall & Sons Terra Cotta Works (1877).

In 1880, he went with James Taylor to Boston. James Taylor has been called the "father of terra cotta" in the United States. He was an Englishman who had worked at the terra cotta factory of J. M. Blashfield, Stafford, England, and he came to America at the time when terra cotta was first introduced into this country; he became the superintendent of the new Boston Terra Cotta Works and Karl Mathiasen was foreman of the pressing department.

Later on, Mr. Mathiasen, with his friend Taylor, went to New York to take up a similar position with the New York Architectural Terra Cotta Company as he had had with the Boston company.

In 1888, with a brother-in-law, O. E. Hansen, he started the manufacture of terra cotta on a small scale, with one kiln, on a plot 75 by 100 feet at No. 2 Catherine Street, Perth Amboy, New Jersey. The partnership consisted of men practical in the terra cotta business, but the Company met with hard competition and suffered from lack of working capital.

In 1893 the New Jersey Terra Cotta Company was incorporated; it took over the partnership mentioned above. The four Eskesen brothers together with a brother-in-law thereupon became stockholders in the Company. From then on the Company enjoyed many years of success until in 1928, as the mother company, it merged with the Federal and the South Amboy Terra Cotta companies under the name of Federal Seaboard Terra Cotta Corporation. Karl Mathiasen was president of the New Jersey Terra Cotta Company from its inception till his death in 1920 when E. V. Eskesen, who had until then been the Treasurer, became President and Treasurer. L. B. Eskesen, who died in 1914, was Secretary for many years.

At the incorporation in 1928 of the Federal Seaboard Terra Cotta Corporation, E. V. Eskesen became President

Karl Mathiasen

of this Corporation and DeForest Grant, who had been President of the Federal Terra Cotta Company, was elected Chairman of the Board. P. C. Olsen, former Treasurer of the South Amboy Terra Cotta Company, was elected First Vice-President and General Manager. Karl Mathiasen, Jr., for several years Secretary of the New Jersey Terra Cotta Company, was elected Treasurer and Secretary and Harry Lee King, formerly with the Federal Company, was Sales Manager.

BUREAU OF MINES LABORATORIES

The United States Bureau of Mines Experiment Station, College Park, Md., was dedicated on October 15, 1937.

The program opened at 9:30 A.M. with a joint meeting of the A.I.M.M.E. Luncheon was served at 1:00 P.M. at the University of Maryland dining hall where the special guests were introduced.

Julian D. Conover, Secretary of the American Mining Congress, presided at the dedicatory exercises. A message was read from Harold L. Ickes, Secretary of the Interior, and addresses were given by John W. Finch, Director, U.S. Bureau of Mines, H. C. Byrd, President, University of Maryland, and Harry W. Nice, Governor, State of Maryland.

NEW RESEARCH ASSOCIATES AT BATTELLE MEMORIAL INSTITUTE

Battelle Memorial Institute has announced the appointment of four Research Associates for the year 1937–1938. Russell H. Lauderdale, Metallurgical Engineer, University of Minnesota, has received an appointment as Research Associate in Physical Metallurgy, to study certain phenomena in the grain-growth characteristics of steel. Carl R. Bloomquist, M. S., University of North Dakota, will study fundamental problems involving the heats of wetting at solid-liquid interfaces as an Associate in the Ore Concentration Division. Robert P. Graham, M. S., University of Washington, has been reappointed for a second year as Research Associate in Ceramics, where he will continue the study of base-exchange phenomena, and John E. Dorn, Ph.D., University of Minnesota, has also been reappointed to continue studies of the solid solubilities of metals and alloys as Research Associate in Physical Metallurgy.

The Research Associate Division at Battelle Memorial Institute was established to extend the work of the Institute in fundamental science. Appointments as Research Associate in Physical Metallurgy, Process Metallurgy, Ceramics, Refractories, Fuel Technology, Coal Preparation, Chemical Engineering, and Industrial Physics are open each year to qualified graduates of accredited universities or colleges, who have demonstrated marked aptitude for scientific research in their industrial experience or in post-graduate study. Research projects in this Division are carefully selected with a view toward the publication of fundamental scientific information and at the same time to provide practical training in the conduct of research investigations.

LALOR FOUNDATION FELLOWSHIPS

The Lalor Foundation at Wilmington, Delaware, has announced a program of five fellowship awards of $2500 each which will be granted for the academic year 1938–39. Applications are to be in the hands of the Secretary, C. Lalor Burdick, by December 31, 1937, and appointments will be made in February, 1938.

The awards will be for research work in various fields of chemistry and related sciences. They may be used for work anywhere in the United States or abroad. As a memorial, however, to the late Arthur A. Noyes, Founder of the Research Laboratory of Physical Chemistry at the Massachusetts Institute of Technology, one of the awards will be specifically assigned to work at that Institution. The Trustees have established this series of awards to aid men of established competence working in fields of pure science, thereby laying needed emphasis on scientific endeavor of a fundamental character as distinct from industrial research and research in applied science.

Appointment is open both to men and women residents of the United States. No age limit is prescribed, but the usual range of ages will be between 22 years and 40 years. Men and women in academic service who are on sabbatical leave or other leave of absence are among those eligible for appointment. High intellectual and personal qualifications as well as creative ability and capacity for productive scholarship are essential elements in the appraisal of candidates. Except in unusual cases the minimum requirement for consideration for the award will be the attainment of the Ph.D. degree, or its equivalent, prior to the submission of application.

Five fellowships are being currently administered by the Foundation, which was organized in 1935. The activities of the holders of present fellowship awards are in the fields of bioörganic chemistry, cryogenics, immunochemistry, photochemistry, and radioactivity, and the institutions at which the researches are being conducted are the California Institute of Technology, Imperial College of Science and Technology in London, Johns Hopkins University, Massachusetts Institute of Technology, and the University of California.

The Board of Trustees of the Foundation comprises Charles Lee Reese, President; John P. Nields, Federal District Judge; Elwyn Evans, Executive Vice-President, Wilmington Trust Co.; C. Lalor Burdick, E. I. du Pont de Nemours & Co., all of Wilmington, Delaware; Mrs. Anna Lalor Burdick, U. S. Office of Education, Washington, D. C.; Henry Allen Moe, Secretary of the Guggenheim Foundation, and Dallas S. Townsend, attorney, both of New York City.

GLASS INDUSTRY PLANS FOR SAN FRANCISCO FAIR

Glass exhibits, according to all indications, will prove one of the outstanding features of the 1939 Golden Gate International Exposition at San Francisco. With three glass manufacturers among the first exhibitors to sign for space, elaborate plans are already being made for industry displays.

Libbey-Owens Ford Company has contracted for a large area in the Palace of Homes and Gardens. This exhibit will include not only such products as automobile glass but other safety glass articles and tableware.

The exhibit of the Kerr Glass Company will promote the use of glass jars in home canning. How the housewife should preserve fruits, vegetables, and condiments will be the theme of the display. The Owens-Illinois Glass Company also has signed a contract for a large space and is contemplating an extensive display.

One of the most interesting exhibits on the 400-acre Treasure Island is expected to be a "House of Glass." This display will be erected in the model home area just outside the Palace of Homes and Gardens and will illustrate the use of screened glass to admit the beneficial ultraviolet rays of the sun.

Advanced plans of many of the exhibitors at the fifty million dollar World's Fair point to many novel uses of glass in the construction of displays. Interesting treatment, particularly in the use of opal and similar glass, is contemplated for the interiors and exteriors of several of the larger restaurants.

More than ten million dollars in building construction, including a million square feet of exhibit space, is now under way on Treasure Island.

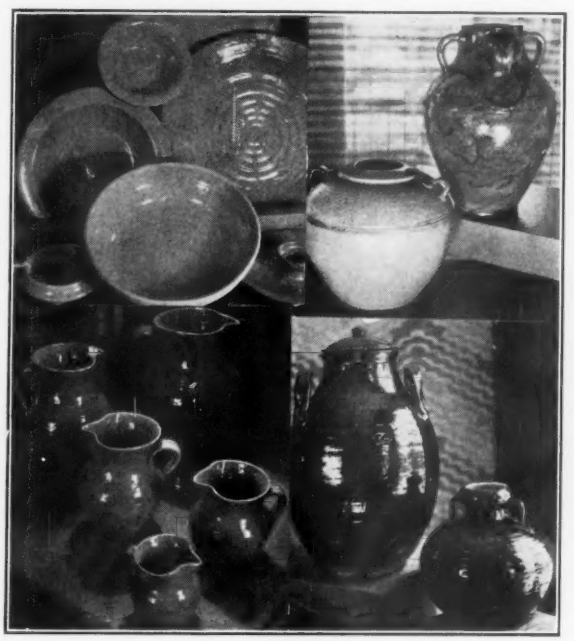
Membership in The American Ceramic Society
Means *Month-by-Month* Ceramic Progress

JUGTOWN POTTERY—A NEW WAY FOR OLD JUGS

By Juliana R. Busbee

Jugtown pottery is the result of our interest extending over many years. The history of North Carolina's country potter is implicit in the name. It dates from the beginnings of English Carolina and has persisted until the present, even surviving state prohibition some thirty years ago. Pottery was a thriving industry when North Carolina voted prohibition on herself. There were perhaps fifty or sixty individual potter shops up and down the old plank road and in the vicinity of Hemp and Seagrove, about fifteen miles apart. Without the jug market there were no profits for the many potter wheels in this district. In the ratio of a dozen churns or crocks or pitchers, the potter sold a thousand or more jugs. Prohibition forced him to discard the trade of his forebears, which was usually handed down in families like medieval crafts. Farming, saw mills, and factories absorbed the sons of men who had generations of potter blood in their veins.

The old potters told interesting tales about camping trips in covered wagons when they peddled their ware and bartered it for things not to be had locally. During the war between the states several potters of this section who were conscripted did not go to the front but, under guard, turned medicine jars for the dispensaries, bowls and mugs for the hospitals, and also telephone insulators. In addition they made "dirt dishes" for the table—plates, pitchers, bowls, and endless utilitarian articles.



Jugtown ware.

In those early days, had anyone stopped at the potter shops in North Carolina and asked if they were in "Jugtown," they would have been directed five or six miles farther down the road. But it was a rainbow's end, for a person never reached an admitted Jugtown because there was an indictment in the name. Naturally, where jugs were made there was also the wherewithal to fill them.

Roughly speaking, the potters of North Carolina fell into three groups: (1) the Staffordshire descendants in the section where Moore, Randoph, and Montgomery counties join, (2) the remnants of the Forsythe County Moravians, and (3) after the Revolution, the Catawba County Germans.

About 1915 Jacques Busbee of Raleigh came upon a bright orange deep pie plate. The color was so arresting—the form so crude and peasant-like—that he was tremendously thrilled. It was that empty pie plate that we set sail in on an adventurous journey. And it has taken us for a long ride, bumpy sometimes, but always interesting. We were like the owl and the pussy cat who went to sea in a beautiful pie plate instead of a pea green boat, and it landed us on shores just as amazing.

At that time we were busy painting portraits, illustrating, and living as conventionally as it was possible for two artists in a small town. My husband and I were interested in handcraft. I happened to be chairman of art in our State Federation at the time; and when making my program I thought (as my husband was making our living with painting) that it was not quite ethical to stress fine arts, so I tried to develop our crafts. As I spoke to and foregathered with other club women about the State, I had an excellent opportunity to see what was being done with crafts in untrodden fields. No interest could be aroused in our State in developing the moribund pottery craft—and we valiantly tried. We did not wish to do the developing ourselves, but because no one else would, we finally set sail in the pie dish. For Jacques Busbee believed that an injection of art into the country potter would bring a new and interesting industry to the State, make our future highways colorful, and would develop a new angle from the age-old one.

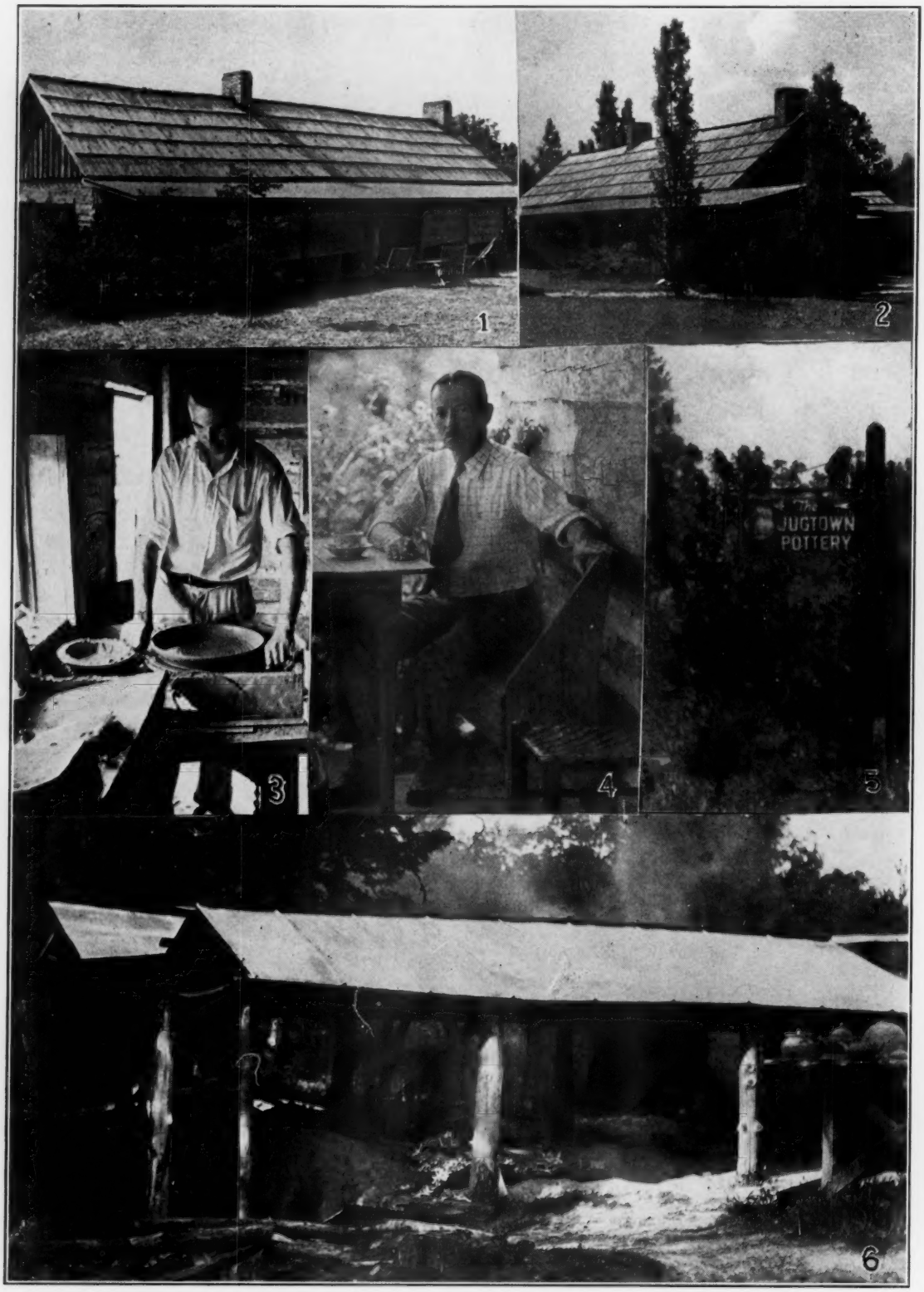
He discovered by accident this district in the eastern Piedmont section. Some of the potters, he found, had come from Staffordshire, England, about 1740. One old potter whose name was Sheffield (pronounced Shuffle) was a mine of information. "Old Joe Shuffle" he was called, and the township is named Sheffield, in Moore County—in what the southern part of the county calls the "dark corner." It is in the upper end. Imagine the surprise of finding his name to be Josiah Wedgwood Sheffield! There is a ballad about him too and it goes something like this:

> "Old Joe Shuffle he kicked a kick wheel,
> Old Joe Shuffle turned pots on a wheel,
> Old man Shuffle he kicked out a jug,
> He drank from it all he could hold."

The moral of the ballad is that he had delirium tremens and killed his pet drake thinking it was a snake.

From house property sales, old books, land grants, and tombstones, much information has been garnered that establishes the genealogy of our potters and the people of this section.

Twenty years ago the burying grounds hereabouts were filled with jug headstones—the top of the jug closed and the inscription scratched on the side. But they are now nearly all replaced with "store-bought white marvel" ones.

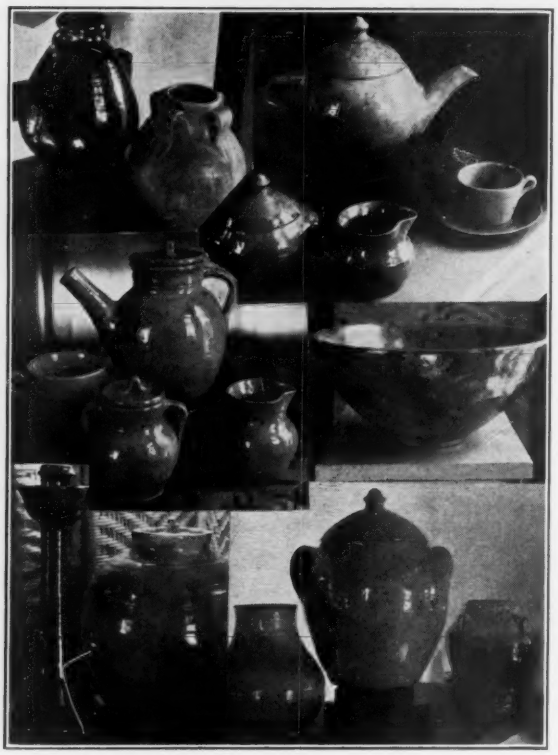


(1) and (2), views of Busbee home. (3) Potter at kick wheel. (4) Jacques Busbee, owner. (5) Entrance marker. (6) Kiln shed.

(1) Side view of Busbee home. (2) Clay shop and ware storage; at left is clay pugging barrel, the knives in which are rotated by mule power. (3) Library in home. (4) Fireplace in dining room. (5) and (6) Glazing bench. (7) Drawn kiln of ware.

In his book on Early American pottery, Barber says that pottery was being made in Virginia prior to 1649. It is reasonable to believe that the potters in this section drifted south from Virginia for safety from the Indians and to preserve their individuality.

Jacques Busbee collected all possible data; he traveled many miles in every direction in this section during this mule and wagon era—collecting all the old pottery possible. Frequently, with my camera, we made all-day trips over roads that were nearly impassable. We photographed everything in this entire countryside that pertained to pottery. Old pieces of ware were collected to establish the tradition of this locality. Much of it is signed and dated. It is not very interesting, but the forms were much more subtle and refined than the pottery of the other sections of the State—and the bright orange color of one of the clays is joyous and certainly different.



Jugtown ware.

Remember that twenty years ago, when we began this adventure, this was a mauve world, and color had not been encouraged to brighten the corners My husband thought in the beginning that he could help the potters with his art knowledge and contacts with the outer world and act as a sort of liason agent for them. At that time, this was literally the interior of North Carolina. The people were shut in by bad roads and poverty. They were suspicious of him because he was different. They were certain he was German for one man said he "seen one onct at High Pint;" another declared he was "one of them Swedens." That we are born and bred North Carolinians they have never believed and never will. Those were pioneer days with us. But we believe that imagination is a frontier and that always there will be pioneers where there is courage, strength, and a will to dare.

It took a bit of courage to set sail in the pie plate for when one has no money one must have other weapons. In a short while it was found that if this pottery was to be rejuvenated we would have to perform the operation unassisted.

So the name "Jugtown Ware" was registered; local potters were secured and the new industry was launched —the pie plate set off to sea! We changed worlds—actually!

As soon as northern magazines and newspapers began to feature this venture, the old potters and their progeny became fired—as they were hoped to be. Potter shops sprang up like mushrooms. Several of them had capital put behind them and two or three have become handcraft "factories."

Then all potters began to claim that they were Jugtown. Every potter in the State swore he was from Staffordshire. One said he was born there! Another in his effort to outdo our date swears he has been making pottery in the same location for over four hundred years! And unthinking people believe it! Another says that his family were "here in B.C.!"

Now all about, along the highways and off, are little potter shops, colorful and interesting, where a man makes his pottery assisted by his wife and children. Production is cheap because wood is the fuel used and the bright cheap glazes attract the tourist trade. But what thrills us is that no potter in our State is on Federal relief, and all during the depression they sold their ware and prospered.

The Jugtown pottery has attempted to keep the pottery in the tradition of this settlement. The shop could have been here for 150 years. The technique is the same as that of the pre-Revolutionary potter—there are no modern short cuts and there is no hurry. We find time to stop in the afternoons for tea in winter and for watermelons or to make ice cream in summer. It is not *how much* is turned in a day's work, but *how beautifully*. I know it sounds imbecile, but we do not know how many pieces are fired in the kiln, what proportion of loss nor how much profit. If we knew we would have quit years ago!

My husband feels that handcraft should be lovingly, sparingly done and that it should never be drudgery. When they go from the old-fashioned glazes and tableware —utilitarian things—my husband seeks the early Chinese for form. And on these simple forms he tries to produce the old Chinese blue. How he does it I feel certain he does not exactly know. He is not a chemist—nor is he a potter. He is an artist; he knows the effect he wants and he has a marvellous memory. So far his reach has exceeded his grasp—as Robert Browning says it should—but with his fingertips he often touches some of the colors for which he has reached.

All of the pottery is fired in the old ground-hog kiln—no saggers, no cones—just in the open fire—believe it or not!

That's about all there is to tell about the pieplate voyage, save after ten years our shop in New York was sold and I came on down here in the back woods "for keeps" and to live happily ever after.

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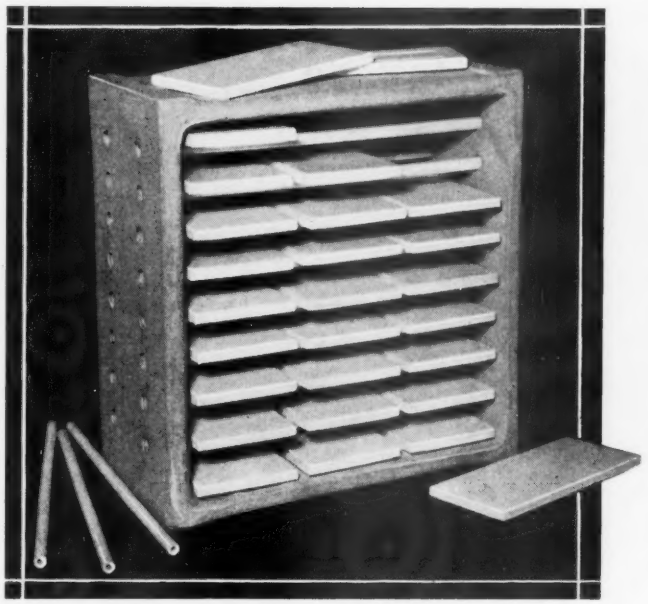

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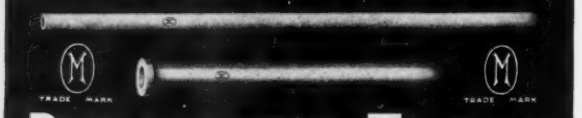
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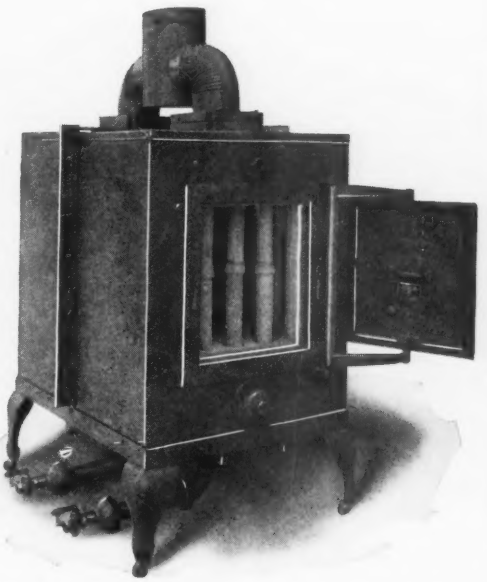

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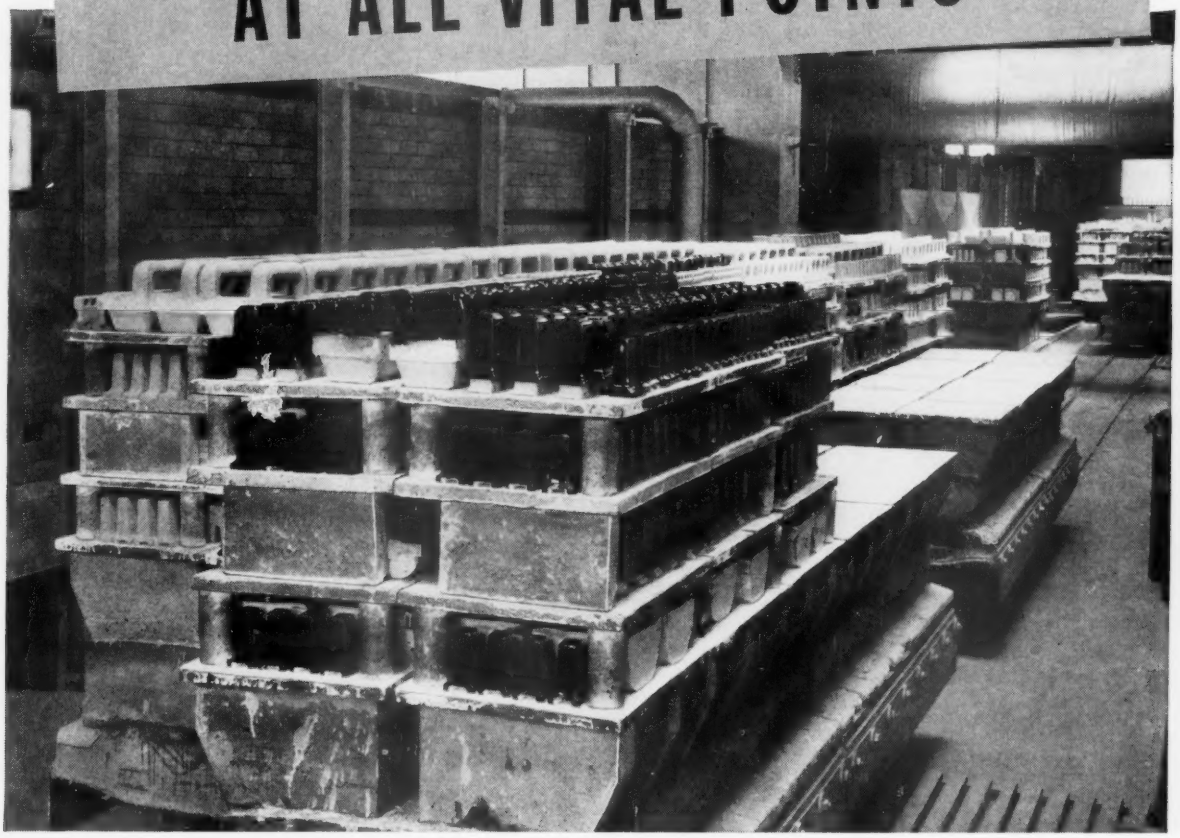

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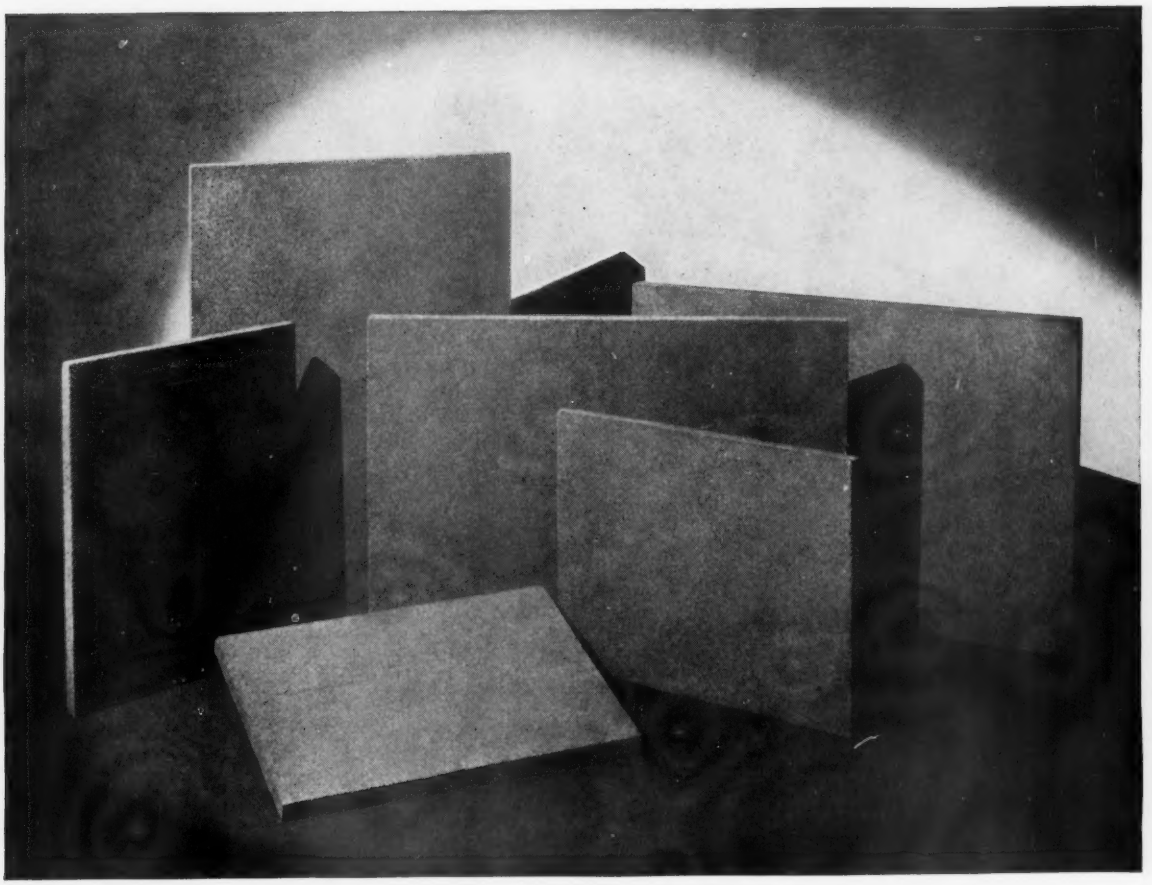

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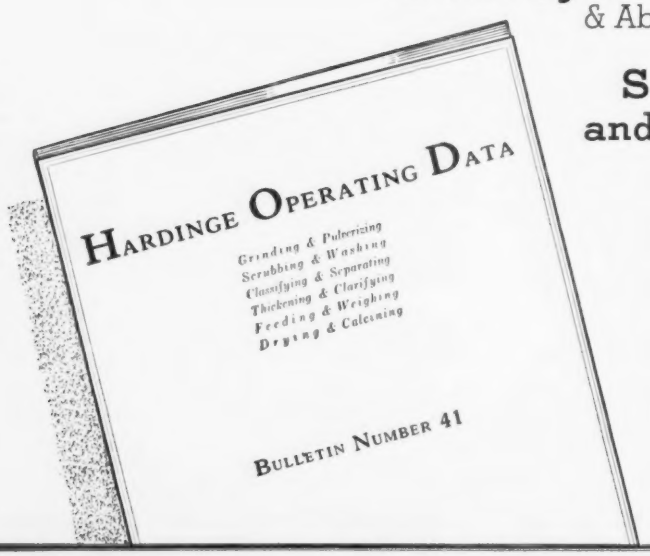

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